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CERTIFICATION OF SEED POTATOES.

REVIEW OF OPERATIONS, SEASON 1928–29.

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BEFORE proceeding with the present review it may not be out of place to outline the salient features of the seed-potato-certification system established by the Department of Agriculture in 1927.

The objective is to supply information that will enable merchants and growers to obtain seed which is true to name, reasonably free from tuber-borne diseases, and of approved cropping-power. Growers are invited to submit their crops for inspection, and to forward with each application one hundred setts from the seed they intend to plant. These samples are then grown by the Department under uniform conditions, in such a manner that it is possible to compare the growth of each line with that of all other lines of the same variety, and to harvest and weigh the product of each so as to determine the relative cropping-power. About January the grower is visited and the first field inspection undertaken. The second inspection follows when the shaws are dying down, and a final tuber-inspection is made when the grower has graded and bagged his seed ready for sale. If a crop passes the necessary standards the grower is issued with a certificate, and sufficient certification tags to enable him to attach one tag to each sack of certified seed he has for sale.

During the season under review certification operated over the South Island only, but next season it is hoped that operations will be extended to embrace the whole Dominion.

CROPPING-POWER.

This second season in which certification has been in operation has brought forward additional proof of the practical importance of what we are terming "cropping-power." It is very obvious that virus disease is the chief cause of the unproductive crop, but the technique of determining its incidence, and more especially the degree of infection, or what might be termed the degree of degeneracy in a particular line, is far from perfect. Potato crops are grown on a wide range of soil-types which vary considerably in fertility, and it becomes impossible

to determine relative degeneracy from a field inspection. The certification trial, in which each line is grown under uniform conditions in replicated plots, affords a means of comparison in the early stages by inspection of the foliage, and later, by digging the plots and weighing the yields, an equally valuable means of determining the cropping-power. This trial is the most reliable guide in deciding whether the line should be accepted, and would in itself be almost sufficient were it not for minor diseases such as eelworm and powdery scab, and the necessity for identifying the field crop so as to be assured that its seed, and no other, is tagged as certified.

In Table 1 are listed the yields of the various lines in the certification trials. The column "Cropping-power" requires some explanation. In a trial where "seed" and "table" tubers are both weighed it becomes difficult to compare a yield showing "seed and table" with another yield of "seed and table" unless the two are added together to give a "total yield."

The disadvantage of using total yield lies in the fact that one would thereby make "seed" of equal value with "table," and from a cropping point of view this seems undesirable. On the other hand, "seed" is of value in cropping-power as an indication of the possibilities of the line on better land, and after several years' experience it has been judged to be equal to about one-half the value of "table." Therefore to determine cropping-power the yield of table plus half the seed is taken into account.

RANGE OF YIELD IN DIFFERENT VARIETIES.

In Fig. 1 an attempt has been made to graphically represent the range of variation in lines of several different varieties.

On the extreme left the variety Epicure shows a great range, and it is generally realized that a great deal of the seed offered on the market is quite worthless and incapable of producing profitable yields. The Bresee's Prolific lines, on the other hand, show little variation (both this season and last), which is explained by the fact that one grower has for many years been the main source of supply of seed of this variety. The Dakotas show a fair range of yields, but there are not so many very bad crops entered this season as was the case last year. It is interesting to note that the grower who topped the list in Dakota and Up-to-date last season retains this unique position for a second year.

Aucklander Short-top (N.Z. Sutton's Supreme) does not show a wide range, with the exception of two or three lines badly infected with leaf-roll. It must be remembered that it is not so many years since the variety was introduced, and during most of this time it has been confined to the Kaiapoi and Rangiora district.

Up-to-date shows a wide range of variation, due mainly to leaf-roll and wilt disease. The highest-yielding strain has maintained its position, and even improved its relative superiority since last season. One would have expected a greater range in the Arran Chief variety than has been obtained. Many of the lines entered, however, contained so many Northern Stars that any computation of yield would have been misleading, and these have therefore been left out.

Table I.—Showing Yield of each Line entered in connection with Certification of Seed Potatoes, Season 1928–29.

The lines were grown under uniform conditions, and each yield is the average of five replications. (See also Fig. 1.)

Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Cropping-power.
Aucklander Short-top :—			
46 ..	6·4	6·3	9·55
29 ..	6·4	5·0	8·9
15 ..	6·5	4 4	8·7
21 ..	6·5	4·4	8·7
58 ..	6·2	4·9	8·65
17 ..	6·0	5·0	8·5
18 ..	6·2	4·6	8·5
33 ..	6·1	4·7	8·45
24 ..	6·3	4·1	8·35
40 ..	5·8	4·8	8·2
32 ..	5·8	4·6	8·1
22 ..	4·9	6·3	8·05
27 ..	5·2	5·6	8·0
36 ..	5·7	4·5	7·95
23 ..	5·9	4·1	7·95
19 ..	5·9	4·0	7·9
34 ..	4·5	6·5	7·75
28 ..	5·3	4·5	7·55
42 ..	5·0	5·0	7·5
30 ..	4·5	5·7	7·4
38 ..	5·0	4·7	7·4
45 ..	5·0	4·7	7·4
25 ..	4·8	5·0	7·35
31 ..	5·0	4·6	7·35
48 ..	5·3	4·0	7·3
26 ..	4·5	5·5	7·25
35 ..	5·0	4·2	7·1
43 ..	4·8	4·6	7·1
39 ..	4·5	4·4	6·7
44 ..	4·5	4·4	6·7
20 ..	4·7	3·7	6·55
37 ..	4·1	3·8	6·0
47 ..	3·0	2·5	4·25
Average ..	5·4	4·7	7·75
Early Regent :—			
168 ..	4·5	3·3	6·15
166 ..	3·6	3·2	5·2
Average ..	4·1	3·3	5·75
Dakota :—			
78 ..	8·2	6·6	11·5
123 ..	7·4	5·7	10·25
70 ..	7·6	4·2	9·7
87 ..	7·4	4·7	9·7
88 ..	7·2	4·2	9·3
75 ..	6·5	4·6	8·8
83 ..	6·4	4·5	8·65
85 ..	6·7	3·9	8·6

Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Cropping-power.
Dakota—contd.			
91 ..	6·7	3·9	8·6
60 ..	6·1	4·5	8·35
79 ..	6·1	4·3	8·25
82 ..	6·0	4·4	8·2
68 ..	5·8	4·7	8·15
62 ..	5·4	5·4	8·1
77 ..	5·4	5·1	7·95
65 ..	5·9	4·1	7·9
66 ..	5·3	5·0	7·8
72 ..	5·2	4·7	7·55
64 ..	5·0	4·7	7·35
89 ..	5·7	2·9	7·15
80 ..	4·7	4·8	7·1
73 ..	4·9	4·1	7·0
84 ..	4·7	4·6	7·0
81 ..	4·5	4·7	6·85
76 ..	4·5	4·5	6·75
69 ..	4·3	4·6	6·6
63 ..	4·5	3·9	6·45
92 ..	4·5	3·8	6·4
86 ..	4·4	3·9	6·35
67 ..	4·2	4·2	6·3
74 ..	3·7	4·3	5·85
90 ..	4·4	2·5	5·65
61 ..	3·6	3·5	5·35
71 ..	2·1	3·2	3·7
Average ..	5·4	4·4	7·6
Golden Wonder :—			
176 ..	4·8	4·9	7·25
177 ..	3·6	4·0	5·6
Average ..	4·2	4·5	6·45
Up-to-date :—			
125 ..	8·7	6·3	11·85
126 ..	5·6	5·5	8·35
132 ..	6·2	3·6	8·0
134 ..	5·2	5·6	8·0
128 ..	6·3	3·0	7·8
133 ..	6·0	3·4	7·7
124 ..	5·6	3·6	7·4
135 ..	5·2	3·5	6·95
136 ..	4·9	3·8	6·8
137 ..	4·4	4·0	6·4
127 ..	3·6	4·8	6·0
130 ..	3·9	2·4	5·1
129 ..	3·0	3·0	4·5
131 ..	2·9	2·5	4·15
Average ..	5·1	3·9	7·05

Table 1—continued.

Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Cropping-power.
Aucklander Tall-top :—			
57 ..	8·4	5·8	11·3
55 ..	8·6	3·8	10·5
162* ..	8·3	4·2	10·4
51 ..	7·8	4·5	10·05
59 ..	8·1	3·8	10·0
50 ..	6·6	5·4	9·3
54 ..	7·0	3·7	8·85
56 ..	6·6	4·2	8·7
Average ..	7·7	4·4	9·9
Bresee's Prolific :—			
98 ..	6·0	4·2	8·1
93 ..	5·7	4·6	8·0
99 ..	6·1	3·7	7·95
95 ..	5·2	4·2	7·3
94 ..	4·9	4·6	7·2
192† ..	5·4	3·4	7·1
97 ..	5·2	3·6	7·0
193† ..	4·8	4·2	6·9
96 ..	4·8	3·6	6·6
Average ..	5·3	4·0	7·3
King Edward :—			
171 ..	6·1	5·1	8·65
170 ..	5·4	4·2	7·5
169 ..	3·6	2·8	5·0
Average ..	5·0	4·0	7·0
Arran Chief :—			
120 ..	7·4	4·5	9·65
107 ..	6·8	4·4	9·0
105 ..	6·7	4·5	8·95
108 ..	6·7	4·5	8·95
102 ..	6·4	4·5	8·65
103 ..	6·4	4·3	8·55
110 ..	6·4	4·0	8·4
101 ..	6·4	3·5	8·15
116 ..	6·0	4·0	8·0
109 ..	5·6	4·6	7·9
104 ..	5·3	3·7	7·15
111 ..	5·3	3·2	6·9
113 ..	4·0	4·6	6·3
Average ..	6·1	4·2	8·2
Epicure :—			
148 ..	5·9	2·7	7·25
146 ..	5·6	3·2	7·2
139 ..	4·4	3·3	6·05
143 ..	4·6	2·8	6·0
Epicure—contd.			
144 ..	4·2	2·7	5·55
150 ..	4·3	2·2	5·4
147 ..	3·3	2·3	4·45
140 ..	2·4	1·7	3·25
142 ..	2·3	1·7	3·15
149 ..	2·4	1·4	3·1
145 ..	2·0	2·0	3·0
141 ..	1·8	1·5	3·15
Average ..	3·7	2·3	4·85
Majestic :—			
156 ..	9·0	4·2	11·1
152 ..	7·6	4·0	9·6
151 ..	5·6	4·8	8·0
154 ..	5·5	3·3	7·15
153 ..	3·1	2·9	4·55
Average ..	6·2	3·8	8·10
Endurance :—			
173 ..	10·5	3·1	12·05
174 ..	5·7	2·8	7·1
175 ..	5·7	2·7	7·05
172 ..	3·8	2·0	4·8
Average ..	6·4	2·7	7·75
Sharpe's Express :—			
180 ..	4·2	3·9	6·15
181 ..	3·2	3·0	4·7
Average ..	3·7	3·5	5·45
Gold Coin :—			
178 ..	7·0	3·1	8·55
179 ..	4·3	3·0	5·8
Average ..	5·7	3·1	7·25
Great Scott :—			
183 ..	6·5	4·1	8·55
182 ..	5·8	4·7	8·15
Average ..	6·2	4·4	8·4
Kerr's Pink :—			
184 ..	3·4	3·1	4·95
Robin Adair :—			
185 ..	7·0	4·7	9·35
New Era :—			
186 ..	4·6	3·5	6·35
Early Rose :—			
187 ..	2·6	3·3	4·25

* Grown some distance away from the other lines, but has the same origin as Nos. 55 and 59.
† Sent in as "Early Puritan."

Table 1—continued.

Variety and Row Number.	Yield in Tons per Acre.			Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Cropping-power.		Table.	Seed.	Cropping-power.
Northern Star :—				*Brownell's Beauty* :—			
188 ..	5·7	5·1	8·25	190 ..	9·9	1·6	10·7
Witchill :—				*Field Marshal* :—			
189 ..	0·6	2·0	1·6	138 ..	6·3	7·7	10·15

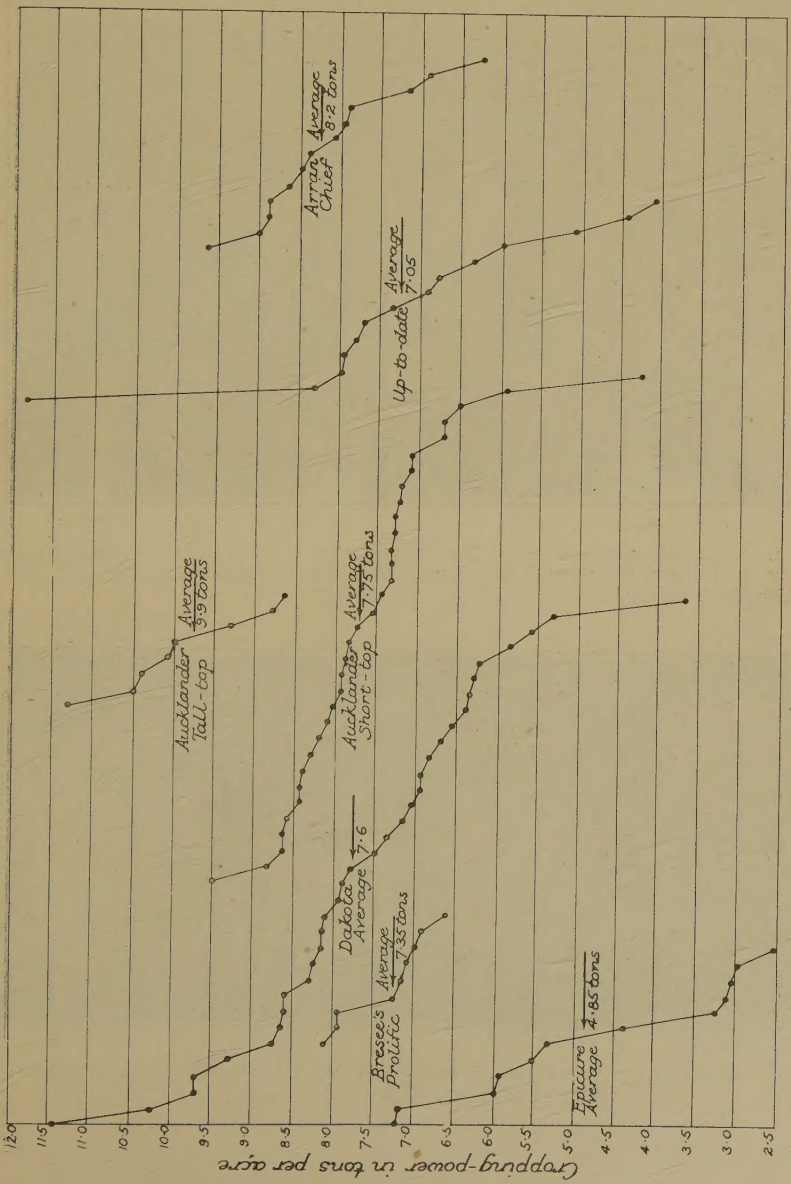
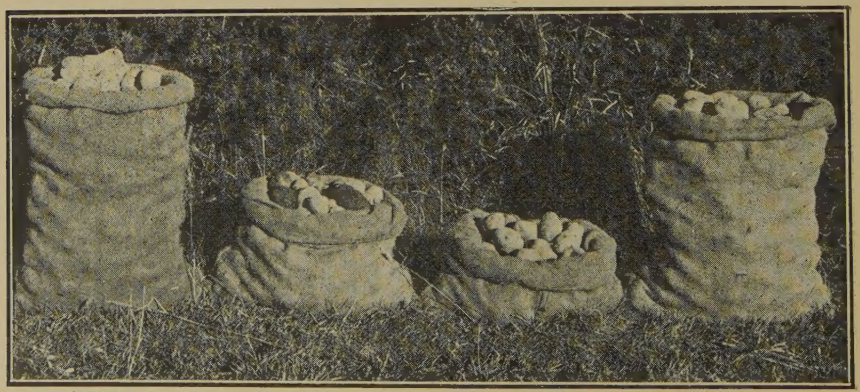


FIG. 1. GRAPHICAL REPRESENTATION OF RANGE IN CROPPING-POWER SHOWN BY LINES OF THE MORE IMPORTANT POTATO VARIETIES UNDER TRIAL.

It is interesting to note that, with the exception of Epicure and other "first-earlies," the average yields of the different varieties are fairly constant, and it is very evident that there may be greater variation within a variety than between one variety and another. Aucklander Tall-top is a notable exception, and is the heaviest-yielding variety under trial. These lines were grown alongside the Aucklander Short-tops, yet the average of the Tall-top is above the highest-yielding line of the Short-tops.

7·4 tons per acre. 11·8 tons. 8·35 tons.

FIG. 2. GENERAL VIEW OF LINES OF UP-TO-DATE UNDER CERTIFICATION TRIAL AT ASHBURTON EXPERIMENTAL FARM, SHOWING VARIATION IN VIGOUR AND CROPPING-POWER.



11·5 tons per acre. 5·35 tons. 3·7 tons. 10·25 tons.

FIG. 3. PRODUCE OF THE TWO HIGHEST- AND TWO LOWEST-YIELDING LINES OF DAKOTA UNDER CERTIFICATION TRIAL.

INCIDENCE OF VIRUS DISEASE.

Any attempt to draw conclusions from counts made during field inspections is liable to be misleading, and in Table 2 is shown the incidence of virus in the certification trials, where the lines are grown under uniform conditions and the counts can be made about the same time. Since it would be unfair to draw conclusions from varieties represented by only one or two lines, these have been left out.

It is important to explain that in these inspections a plant is recorded as diseased only when its vitality has been reduced to such an extent as to render it definitely subnormal. Thus in each case there is evidence that the vitality and yield have suffered, and that this is directly attributable to virus, in particular to that virus which is recorded against it.

It is not possible to describe at all clearly the degree of degeneracy at which a count would be recorded, but after some practice those concerned in making the counts can establish a satisfactorily uniform standard. Such a system may be open to criticism, but the objective has been to determine the extent of the damage done by virus in each line, and if one were to take the total incidence there would result such valueless figures as "Up-to-date, 100 per cent. leaf-roll," or "Iron Duke, 100 per cent. mosaic," both of which would be literally true.

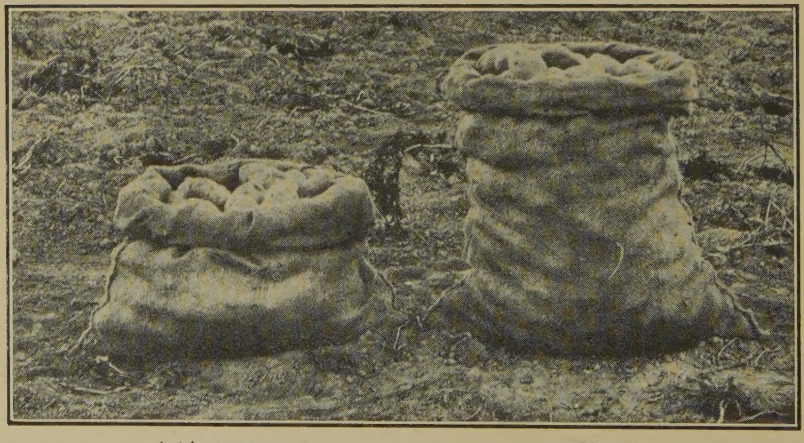
Table 2.—Incidence of Virus Disease in Trial Plots at Ashburton Experimental Farm, Season 1928–29.

Lines examined. (100 Plants in each Line.)	Leaf-roll.		Mosaic.		Stipple-streak.		Crinkle.		Total.	
	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.
Aucklander Short-top :—										
32 ..	13·3	0–59	0·2	0–2	1 plant		1·5	0–8	15·0	1–61
Aucklander Tall-top:—										
8 ..	7·1	2–16	1 plant		..	..	0·7	0–3	8·0	2–17
Dakota :—										
34 ..	16·5	0–79	8·0	2–16	..	..	0·8	0–6	25·2	4–79
Bresee's Prolific :—										
8 ..	3·5	1–10	10·9	6–16	2·6	0–14	0·6	0–2	17·6	9–25
Arran Chief :—										
14 ..	2·4	0–14	22·7	13–52	1 plant		2·1	0–9	20·3	19–62
Up-to-date :—										
15 ..	40·3	2–63	1·9	0–6	3·2	0–17	1 plant		45·4	5–77
Epicure :—										
9 ..	4·1	1–7	22·8	0–45	..	..	2 plants		27·1	5–48
Majestic :—										
5 ..	35·0	13–74	2·6	1–5	2·2	0–11	..	..	39·8	15–75
Iron Duke :—										
4 ..	24·0	4–50	*8·0	*5–12	1 plant		..	..	32·2	16–56
Endurance :—										
4 ..	6·0	2–12	23·5	6–33	1·0	0–4	8·0	4–18	38·5	13–56
King Edward :—										
3 ..	10–0	1–27	2 plants		1 plant		18·7	0–55	29·7	3–59

* Only the most severe mosaic recorded.

FIG. 4. CROPS OF AUCKLANDER SHORT-TOP AT ASHBURTON EXPERIMENTAL FARM.

The line on left was seriously affected with leaf-roll, this being responsible for the lower yield shown on left of Fig. 5.



4·25 tons per acre. 9·55 tons.

FIG. 5. YIELDS OF THE TWO LINES OF AUCKLANDER SHORT-TOP SHOWN IN FIG. 4 ABOVE.

When a plant is affected by more than one virus the most obvious one is recorded. A good deal of difficulty has been experienced in differentiating between "crinkle" and "advanced mosaic," but in a general way the figures are interesting, and indicate that leaf-roll is the most serious virus disease, and is most in evidence in Aucklander Short-top, Dakota, Up-to-date, Majestic, and Iron Duke. Mosaic is by no means so serious a factor except in Arran Chief. The high percentage of mosaic recorded in the Epicure lines may be somewhat misleading, as much of it was extremely difficult to identify. Although for two years we have been unable to find a single Iron Duke free from mosaic (only the most advanced cases are recorded in these counts), yet this disease is not the main cause of the many failures of this variety. Leaf-roll is the primary cause, and while the variety is tolerant to mosaic it succumbs at once to leaf-roll.

These counts were made in January, and stipple-streak is more in evidence later in the season, so that the figures recorded are not indicative of the damage caused by this virus.

REASONS FOR REJECTION.

It would be easy to tabulate from our field-books all the reasons given for rejecting crops, but it would be extremely misleading. A crop may be subject to rejection for several reasons. If it contains a high percentage of foreign varieties it is rejected and no other records are taken. The field-book records are intended to be of practical value in deciding upon acceptances and rejections, and not for the purpose at present in view. Table 3 shows reasons for rejection, covering all varieties, and should be a fairly close approximation. Of the 167 crops eligible for inspection, the numbers (and percentages) given in the table were below the required standard for the reasons indicated. Some crops are recorded as being rejected for more than one cause. Sixty-six crops, or 40 per cent., received provisional certificates.

Table 3.—Summary of Rejections.

Number of Crops.	Rejection Percentage.	Reasons for Rejection.
51	30·5	Insufficient cropping-power due to virus infection.
39	23·4	Above 2 per cent. of foreign varieties.
12	7·2	Powdery scab.
9	5·4	Eelworm.
5	3·0	Late blight.
2	1·2	Wilt diseases.

AREAS PROVISIONALLY PASSED.

Provisional certificates are issued after the second field inspection, and are in effect a statement that the grower will receive a certificate provided the final tuber-inspection reveals the same standard as has been indicated by the preceding field inspection.

From the list given in Table 4 it will be seen that while the number of growers and the number of varieties have increased this season there

Table 4.—Crops of each Variety provisionally certified, 1927–28 and 1928–29.

Variety.	Number of Crops.		Area in Acres.	
	1927–28.	1928–29.	1927–28.	1928–29.
Aucklander Short-top	7	11	75	67
Aucklander Tall-top	5	4	30	17
Dakota	11	12	121	81
Bresee's Prolific	10	4	106	54
Arran Chief	4	9	36	54
Up-to-date	3	5	13	20
Epicure	5	6	13	15
Endurance	1	3	1	4
Early Regent	1	2	35	23
Majestic	Nil	2	Nil	6
Great Scott	Nil	2	Nil	2
Golden Wonder	Nil	2	Nil	4
Field Marshal	Nil	1	Nil	7
Brownell's Beauty	Nil	1	Nil	1
Northern Star (Gamekeeper) ..	1	1	35	12
King Edward	Nil	1	Nil	2
Robin Adair	2	Nil	6	Nil
Totals	50	66	471	369
Average areas ..	..	..	9·4	5·5

is a considerable decrease in the total acreage. The average area per crop is little more than half of what it was last season, and this is a definite indication that growers are confining their attention to smaller areas with a view to bringing these up to a higher standard.

Sixty-five provisional certificates have been issued to growers. A list of these, together with the respective acreages, was published in last month's *Journal* (page 363), to which those interested are referred. The present opportunity is taken to make some slight amendments: Under "Up-to-date" the name J. R. Robinson and Co. should be I. Robinson and Co.; under "Arran Chief" the area grown by F. A. Rollinson and Sons should be 18 acres; under "Epicure" add A. Spillane, Temuka, 3 acres.

SALT CONTENT OF BUTTER.

THE percentage of salt suitable for most markets is 1·8 up to but not exceeding 2·0, and this is our general recommendation to buttermakers. Special orders occasionally come to hand for a slightly higher percentage, and factories filling these orders usually notify the Grader to that effect. The tendency on the part of some factory-managers to increase the salt content merely to increase the overrun is a short-sighted policy and should be discouraged. Where the salt content is heavy and the water content high it is easy for butter to contain less than the legal content of 80 per cent. of fat. In such cases action can be taken against the makers, and the rule is to deal with such butter in the same way as butter with an excess of water is dealt with.—*Dairy Division.*

CONTAGIOUS ABORTION IN DAIRY CATTLE.

PRACTICAL POINTS FOR FARMERS.

Live-stock Division.

CONTAGIOUS abortion in dairy cows, resulting as it does in the loss of calves and milk-supply, is a disease that requires the most careful attention by our farmers. It is only by studying the nature of the disease that proper and effective measures can be taken to control and prevent the spread throughout a herd. There is also the serious aspect of sterility and loss of breeding as a sequel to the disease. Probably contagious abortion is a more common factor than any other in causing permanent sterility in cows, as distinct from the condition of temporary sterility which so frequently occurs in this country.

The disease is a very insidious one, and may be present in a herd for some weeks or months before an actual abortion takes place, which act is the only outward sign for the farmer that something is amiss. The disease is due to a specific organism — Bang's bacillus — which invades the womb of the pregnant animal, setting up a chronic inflammation between the membranes and the wall of the womb. Later the blood-supply of the developing fœtus is cut off by this inflammation, the fœtus acts as a foreign body, and the stimulus is given for the act of abortion.

All pregnant bovines are liable to infection, but probably first-calving heifers are more susceptible, as they have not previously had an opportunity of developing any immunity to the organism. Once an animal has aborted a certain degree of immunity is developed, but this may not be sufficient to enable the animal to remain pregnant throughout the full period of a second pregnancy. Invariably, however, the infected animal will carry her third calf the full period. At each and all of these births the cow is a possible source of contamination of pastures through the discharges which come away at parturition.

At the time of abortion there is generally a profuse discharge of a yellowish chocolate-coloured appearance, which is most dangerous from an infective viewpoint. As infection occurs in the majority of cases through ingestion of food or water contaminated by the discharge from a previous case of the disease, the necessity at once becomes apparent of detecting a recently aborted cow, isolating such an animal in a paddock by herself, effectively dealing with all the discharges by burning, burying, or spreading them over with freshly burnt lime, keeping the animal isolated from the herd until all discharge has ceased, washing the vaginal passage and the womb itself (when possible) at regular intervals while the discharge lasts, washing the external genitals and tail with weak antiseptic solutions at regular intervals, and taking all other known precautions to prevent contamination of the remainder of the herd.

It is true that occasionally abortion of a sporadic nature, and not due to the specified organism, does occur. Such cases usually result from an injury, a fall on rough country, excessive dogging and trucking, and dietetic causes such as frosted roots or fermenting foodstuffs likely

to cause severe indigestion and "bloating." It is much safer in dealing with abortion disease to treat every case as contagious and adopt preventive measures until the cause is proved otherwise.

For the detection of the disease the farmer himself, or a reliable deputy, should carefully examine his herd twice daily at each milking-time. In this way any animal suspected of early or premature calving, as shown by the appearance of the external genitals, can be isolated from the herd. A small isolation paddock close to the homestead is essential for this purpose. The paddock can be used for calves if not otherwise required.

When abortion has taken place there is a tendency for retention of the fœtal membranes. Such retention is likely to cause a chronic inflammation of the womb through the invasion of secondary organisms, which is undoubtedly a common cause of sterility afterwards. This being so, certain measures, such as the careful removal of the membranes by hand, together with frequent flooding and washing out of the womb with weak antiseptics at regular intervals, are recommended.

As curative measures are not satisfactory and as vaccination against the disease is also unsatisfactory in bringing about immunity against attack, farmers are advised to use all their powers of observation in the early detection of the disease, and to take every possible precaution to prevent its entry and spread in a herd.

The method of control of the disease which, in the present state of world knowledge, offers more hope of success than any other is the building-up of an abortion-free herd in the case of an already badly infected herd, and in the case of a slightly infected herd the elimination of all reactors to the blood agglutination test. With this disease more than any other the farmer should provide his young stock by rearing his own heifers, thus preventing the introduction of the disease from outside sources. When getting rid of animals which have aborted the works should be availed of, as if these animals are passed through the saleyards an unsuspecting buyer may thus introduce the disease to his herd.

The bull may transmit the disease from an infected animal to a clean animal by actual physical contact or through service. The bull may even harbour the organism in his genital organs. However, by far the commonest method of infection in cows is by ingestion of contaminated food or water.

In diagnosing the extent of the disease in any herd a physical examination of the animals is not of much assistance. The laboratory test known as the agglutination test is quite dependable; to enable this to be carried out samples of blood taken under conditions which prevent contamination are necessary. The Veterinary Laboratory at Wallaceville tests hundreds of samples of blood for farmers annually, and gives them the true extent of the disease in their herds if present.

After abortion has taken place it frequently happens that such animals appear in season very soon afterwards. On no account should these animals be allowed to the bull until at least six weeks or two months after all discharge has ceased. To effect this it is absolutely essential that the bull should be kept under control and not allowed to mix with the herd.

WALLACEVILLE VETERINARY LABORATORY.

CONTROL POINTS SUMMARIZED.

Essential points in the control of contagious abortion may be summarized as follows :—

(1) Do not allow the bull to mix with the herd. Take the cows to him for service when considered clean.

(2) Wash out the sheath of the bull after service of a suspected unclean cow.

(3) Isolate a cow immediately abortion has taken place, or preferably before the act has taken place, if possible.

(4) Destroy the fœtus and all discharges afterwards by burning or by quicklime.

(5) Keep the cow in isolation until all discharge has ceased, and do not allow service until at least six weeks after all discharge has ceased.

(6) Give frequent and regular douching and washing of the womb and external genitals immediately after abortion, and while the discharge is coming away.

(7) The solutions for douching recommended are weak solutions of Condy's crystals in water, or normal saline solution (1 oz. salt to 1 gallon water).

(8) Rear your own heifer calves and become independent of outside buying, hence running less risk of introducing the disease into a clean herd.

(9) When disposing of aborting animals send them to the works, and do not risk contaminating saleyards and clean cattle.

(10) When buying animals for introduction into a clean herd buy subject to their passing the agglutination test.

(11) Do not allow bulls to wander at large ; the scrub bull is always a menace in this respect.

In order to effectively deal with these recommendations extra labour on many farms would appear to be necessary. At the same time the extra returns from an abortion-free herd, and a reduction of the

incidence of the disease in the country as a whole, with the consequent increased annual output of milk and milk-products, would compensate manyfold for the extra labour involved. There is probably no disease in which careful management and regular attention by the farmer is better repaid.

THE BLOOD AGGLUTINATION TEST.

Mr. C. S. M. Hopkirk, Officer in Charge of the Veterinary Laboratory, Wallaceville, contributes the following notes :—

For some time past the field officers of the Live-stock Division of the Agriculture Department have been advising farmers to make use of the special blood-test known as the agglutination or the serological test, in order to determine whether cows in their herds are harbouring the germs of contagious abortion, and to separate any affected animals from the clean cows and keep them separate.

Lately in the United States a committee consisting of men of very great experience has made an inquiry into contagious abortion, and published a report which is worth repeating as the last word on the subject. Their main conclusions are published in the *Journal of the American Medical Association*, Vol. 74, March, 1929. In these they call attention to the following facts :—

(1) Contagious abortion is now a controllable disease.

(2) The serological [agglutination] tests are sufficiently accurate to serve as a basis for freeing herds of the disease.

(3) Clean herds, so indicated by the agglutination tests carefully applied and interpreted, can be maintained clean year after year.

(4) Herds thus maintained show a breeding-efficiency far above that which is recorded in herds which contain many animals that react to the serological tests.

(5) Other things being equal, herds that are entirely clean are the best breeding-units that can be obtained. Those that consist entirely of reactors, carefully culled, can be made to show fair breeding-efficiency. Those consisting of reactors and non-reactors in association show a minimum breeding-efficiency as compared with the two other groups.

(6) Clean units may safely be recruited with young stock from infected units, provided the serological tests are made the basis of the transfer. Thus the infected unit may often be made to serve as a source of some income until the clean unit can be established, and the blood lines that the breeder prizes can easily be perpetuated.

(7) Testing abortion disease out of a herd or unit and keeping it out is the only known successful way to handle it.

These conclusions fully support the views held in New Zealand. Dairy-farmers are advised to have a blood-sample taken from each member of their herd. This can be done by the farmer himself in the following manner :—

(1) Procure ½ oz. medicine-bottles with corks to fit, one for each head of cattle of breeding-age on the farm. Boil such bottles in a billy, and dry them in the oven. Cork each bottle and label it ready for taking to the cow-shed. Each bottle must be dry, must be sterile, and must be labelled with a mark distinguishing the respective animal.

(2) Cut the hair from the tip of the tail of the cow with scissors so that the blood will run into the bottle without touching the remaining hair. Do not destroy the whole "brush," however, as such would be unsightly, more particularly in pedigree herds.

(3) See that the end of the tail is cleaned. This is done preferably with a cloth soaked in methylated spirits, but the tail must be dry before the blood is taken.

(4) Cut the tail with a *sharp* knife longitudinally in the centre for the last inch. Give a good firm cut. Do not get your fingers in the way at the back of the tail, because the knife should cut right through, and only the cow's blood is required.

HOW TO TAKE THE BLOOD SAMPLE.

(5) Allow the tail to hang down straight, and do not apply any pressure with the fingers or the flow of blood will stop. Should bleeding be too slow the cut may be lengthened or deepened, but if the bleeding is too fast the cut may require tying with a strand of hair from the tail.

(6) Fill the bottle, if possible. A full bottle helps the sample to carry well in the post. Also, if bottles are left standing until the blood is thoroughly clotted there is less likelihood of spoiling.

(7) Send the samples by rail or post to the Officer in Charge, Veterinary Laboratory, Wallaceville, per Private Bag, Wellington. They must reach the Laboratory without delay. Pack securely to obviate breakage, and enclose name and address. A separate letter should also be sent, so that the veterinary officer testing the sample may know the state of the herd so far as this is known to the farmer.

A SURVEY OF PUMICE SOILS.

THE SUBSOILS OF ROTORUA COUNTY.

(Continued.)

B. C. ASTON, Chief Chemist, Department of Agriculture.

IN the first portion of this article, published in last month's *Journal*, endeavour was made to show the great influence on the surface soil exerted by the subsoil texture. For the purpose of photographic presentation of subsoil sections (page 297) exactly opposite examples were selected. Where the subsoil was non-permeable or difficultly permeable, swamp with its typical vegetation specially adapted to withstand stagnant moist conditions developed, forming a pure association of raupo or bulrush. Where the subsoil was easily permeable a highly aerated leached soil resulted, showing at the edge of the section where extreme droughty conditions prevailed a growth of that typical drought-resistant plant (or xerophyte) gorse, although the rainfall is some 60 in. annually. In between these extremes in this county one does not need to travel far to detect all grades of examples showing the influence of subsoil on the water content of the soil, and the consequent response of characteristic vegetation suited to dry-soil conditions on the one hand or wet-soil conditions on the other.

Results of Mechanical Analysis.

By mechanical analysis is meant the separation of the soil by purely mechanical (not chemical) methods into a number of groups of particles, each group containing only particles of a limited range in size. To each group is given a name which, although taken from everyday English, is here used in a definite sense and intended to convey the idea of a definite fixed texture varying only within narrow limits. From the proportion in which each group is present in a soil it is possible to predict the general physical properties of that soil.

In soil science the names given to the differently sized groups are, in the descending order of magnitude, " stones," " gravel," " sand," " silt," and " clay." By adding the qualifying words " coarse " or " fine " to each—except the " stones " and " clay "—are obtained terms which enable the soil to be represented in eight different fractions. This now gives a means of classifying soils of similar origin and composition when situated in similar climates, and classification is the first essential to the effective study of any kind of natural phenomena. The practical man may argue that he knows a sand from a clay soil without analysing it. It may be readily conceded that he can tell extremes, but even the practical man would stand appalled at being asked to assign a character to any mixture of eight different ingredients, a task which mechanical analysis can and will do. In fact, by this means one is enabled to compare soils from any part of the world having the same climate, for, as Sir John Russell has aptly said, " the soil is the child of the climate."

It is, however, one thing to attach a certain definite numerical character to a soil and another to interpret that character. Soil science is not yet advanced to such an extent that predictions may be made as

to what will occur in the field with a soil having any known combination of differently-sized particles as shown by mechanical analysis, although it is a method by which soils may be classified and compared, and, broadly speaking, their behaviour under changes in conditions brought about by climate, tillage, and manuring explained. With a mechanical analysis of a soil one need not be afraid of falling into the somewhat common error of calling a silt a clay, a distinction which conveys a very great difference.

Now, although mechanical analysis can reveal the proportion of each differently-sized fraction, it cannot tell how these particles are arranged to form what is known as "soil-crumbs." A soil is not a mere indiscriminate mixture of coarse and fine particles. Certain of the finer particles tend to run together into aggregate masses, and it is these "crumbs" which are largely responsible for the tilth of a soil. Alkalis such as carbonate of soda break down these crumbs and "deflocculate" the soil, while lime carbonate (or bicarbonate as it exists in the soil solution) acts in the contrary direction, causing the particles to run together. The smallest amount of free carbonate of soda in the soil solution has a very deleterious effect on the mechanical state of the soil: it forms "sodium clay." When "sodium clay" is acted upon by the application of carbonate of lime (ground limestone) sodium carbonate is formed again, and is free to recommence its vicious cycle; but if instead of ground limestone gypsum or land-plaster (sulphate of lime) is applied calcium clay is formed and sodium sulphate is liberated, which is not alkaline, and may be washed out of a soil in the drainage-water.

Something similar to this may be one cause of the deterioration going on in parts of the Hauraki Plains* in the course of "breaking in" a mangrove-swamp country originally charged with salts of sea-water, which would act as flocculating-agents for a time and improve tilth and fertility. When most of the salts have been washed out sodium carbonate may be formed in the soil, and a breaking-down of the soil-crumbs ensues to such an extent that capillarity and what is known as tilth are destroyed, while in summer a droughty condition may result, accentuating the effect of any poisonous salts or alkalis. The quick death of pasture at certain points on the Hauraki Plains may be due to the poisonous action of magnesian salts derived originally from the sea-water. After those of soda the next most abundant salts of sea-water are those of magnesia. The drainage subsoil water taken from a depth 3 ft. below the surface is highly charged with magnesian salts. The remedy may be to land-plaster the area, but further experiments are on foot to determine the exact treatment that a laboratory study of the soil can suggest.

As previously mentioned, land-plaster is hydrated sulphate of lime or gypsum. It is much more soluble in water than carbonate of lime, and effects notable improvement in the case of calcium-hungry soils or magnesia-sick soils. It is therefore suitable for treating many areas in districts containing serpentine rocks and the soils derived from them, which are rich in magnesia. It should be noted that much smaller

* For an account of this type of country, with analysis of soils, see article in this *Journal* for June, 1914, "The Hauraki Plains: Some Notes on the Soil."

quantities of gypsum may be effective than are required of ground limestone; 4 cwt. per acre is a fair dressing. (See article, "Magnesia and Plant Growth," in the *Journal* for December, 1915.) It is worth remembering that superphosphate contains more than half its weight (60 per cent.) of sulphate of lime, so that for every 3 cwt. of superphosphate more than 200 lb. of sulphate of lime is being applied per acre.

There are some highly nutritive fodder and pasture plants which are able to grow well in a soil containing a large proportion of sea-salts, and are accordingly to be found flourishing in many maritime estuarial situations subject to seasonal tidal submergence with salt or brackish water and consequently receiving deposits of salts in the soil when the water has drained away. There are other plants which do not grow wild but flourish when cultivated on salty lands, and it is probably no coincidence that some of these plants have been derived from ancestors —for example, colewort and *Beta maritima*—which originally grew in salty littoral situations. All plants belonging to the family *Cruciferae* would probably do extremely well in salty soils, such crops as turnips, kale cabbage, kohl-rabi, rape, mangel, and sugar-beet, the latter two belonging to the family *Chenopodiaceae*.

The treatment of lands suffering from such defects, which can always be traced to the subsoil influence, therefore resolves itself into attempts to (1) grow a plant covering or crops which will withstand the salty influence, and (2) to remove that influence. As a sward it would be hard to beat *Trifolium fragiferum*, or strawberry clover, which flourishes in many salty areas throughout the North Island at sea-level, notably at Kaipara Harbour and at Himitangi, near Foxton. Such a sward, however, would provide an unbalanced ration, which would have to be supplemented by fodder of a lower protein content. The food value of strawberry clover is considered by practical farmers to be very similar to that of white clover, and it certainly has an amazing habit of establishing itself and spreading in brackish stations, where it is greedily sought by stock.

Mention of Himitangi brings yet another instance of subsoil influence from which one may derive instruction, for here the soil and subsoil is the usual dune-sand of the North Island west coast, consisting of about 90 per cent. of sand of uniform grain. The salt here cannot influence the textures prejudicially, owing to the absence of fine particles and the resultant soil-crumbs. The porous subsoil therefore allows the excess of salt to drain away to the watertable.

The experience of European countries having lands subject to salt-water invasion indicates that where the soil is argillaceous (clayey) there are good yields at first, but that when the excess of salts is washed away into the subsoil layers the results rapidly go from bad to worse.

It may be seen, therefore, that with very porous coarse-textured soils such as that of dune-sands and coarse pumice soils, where the physical conditions are such that salt cannot alter the texture by flocculation and deflocculation, disturbances in the fertility due to this cause cannot occur. In this type of soil the difficulty is to obtain a denser packing of the soil-particles, so that the evils due to excessive mobility and porosity—lack of water-holding power—and the consequent liability to suffer from drought and leaching of plant-foods may be diminished. In

fine-textured clayey and loamy soils, on the other hand, where the particles are already fine enough, and the necessary tilth has been induced by a judicious flocculation of the finer clay particles and admixture of organic remains, enabling the soil to be aerated, puffed up, and lightened, a breaking-down of the soil-crumbs by the ultimate action of salt water upsets in a short time the work of many years that was required to make it a fertile medium for plant-growth, capillarity is diminished, the soil pores are blocked by fine particles, air cannot enter, water becomes too abundant in wet periods and deficient in dry periods, and a general stagnation of life in and on the soil follows.

One of the most convincing examples of the value of mechanical analyses of soils is its use to differentiate soils in their capacity to grow the different qualities of tobacco, for, given suitable climatic conditions, the type of tobacco produced is determined by the soil, and particularly by its mechanical and physical condition. For instance, a clay soil gives a heavy-cropping tobacco which cures to a dark-brown or red colour, whereas a sandy soil gives a thin leaf curing to a yellow or light-red colour. American experience has proved that in the same locality and under the same climate quite different kinds of tobacco may be produced in direct relationship to the character of the soil. All tobacco soils should be well drained and have a high humus content.

Milton Whitney, the United States Government Soil Chemist, as head of the Bureau of Soils in the "nineties," did much to spread correct information regarding the types of soil on which to grow the highest quality of tobacco, and now the United States produces more tobacco than any other country in the world. Whitney, by the use of mechanical analysis, proved that certain soil areas of the Connecticut Valley were practically identical, as regards texture and water content, with certain areas in Florida upon which the finest of cigar-wrappers were grown from Sumatra seed. Experiments were accordingly made on one of the Connecticut areas, using the same seed and methods of cultivation and curing employed in Florida, with the most satisfactory results. Whitney estimated that this additional area made available would lead to a quality of tobacco being grown locally which hitherto had to be imported to the amount of six million dollars annually. New Zealand is becoming a tobacco-growing country, and our experience is likely to accord with that of the United States.

In New Zealand are all types of soil and many climates. During the past season the writer observed some fine tobacco growing in the Rotorua district. It seems extremely probable that a very fine and valuable quality of leaf could be grown in one of the types of pumice in which the "humus" content is high. Experiments at the State Forest Service nursery at Whakarewarewa have proved that the humus content may be greatly increased by green-manuring, so that if not high enough the organic matter can easily be reinforced.

The mechanical analyses of the subsoils of the northern part of Rotorua County are given in the accompanying tabular statements, and reference should also be made to the map published last month. It will be seen that the texture of the subsoils, which depends on the differently-sized particles of soil, is remarkably uniform over wide areas. Uniformity of character in the second 9 in. of soil closely follows uniformity in the top 9 in. These soils and subsoils are all deposited from

MECHANICAL ANALYSIS OF SUBSOILS, ROTORUA COUNTY (NORTHERN PART).

Results are percentages on air-dried soil.

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Location.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.		
						Coarse Sandy Silts.					
R 1122	Coarse sandy silt ..	7·8	35·0	21·7	16·7	4·2	0·8	2·4	9·8	Trace	Florey's.
S 470	,, ..	6·6	34·7	24·3	16·4	4·5	0·7	2·1	9·2	5·9	Moxham and Gardiner's, above Hamurana.
473	,, ..	8·7	34·2	22·6	14·9	4·6	1·0	2·0	10·6	6·3	Kapakapa Road.
476	,, ..	9·8	36·6	17·9	15·0	4·5	1·7	4·04	9·78	7·0	Florey's farm.
T 504	,, ..	8·88	36·53	20·80	14·95	6·28	0·7	2·48	7·68	4·2	J. Sherriff, Sections 76 and 9, Block 4, Horohoro S.D.
512	,, ..	3·67	34·0	25·21	15·96	4·75	1·2	3·40	10·30	4·5	C. Andrew, Sections 11 and 2A, Block 4, Horohoro S.D.
516	,, ..	3·52	31·25	26·43	16·18	4·86	0·8	4·16	12·12	1·3	Ngongotaha Mount Road. Bush.
518	,, ..	13·34	19·44	29·12	18·55	5·24	0·9	2·64	9·76	8·7	Ngongotaha Mount Road. Fern.
532	,, ..	13·1	31·2	23·1	12·6	2·8	0·5	6·2	10·5	12·8	Jolly's change paddocks, Hamurana. Hill slopes.
563	,, ..	7·3	32·4	25·7	14·7	3·2	0·8	2·8	11·6	2·1	H. Ward, Dudley Road, Te Pu.
565	,, ..	13·3	34·11	19·7	14·4	4·2	1·4	1·4	10·0	Trace	Fern slopes, adjacent to T 563.
567	,, ..	12·0	32·0	25·0	14·8	3·2	0·9	2·1	9·1	4·0	Lower slopes, E.R., Dudley Road, Te Pu.
569	,, ..	8·0	33·7	24·4	15·5	3·5	1·5	2·0	10·2	Trace	Flat tops, E.R., Block 4, Dudley Road.
571	,, ..	6·3	29·1	27·3	15·8	3·6	2·0	5·3	10·6	,,	Kakahi Village.
583	,, ..	9·6	24·2	21·4	15·2	5·3	1·6	12·8	10·3	,,	Oakley's, Lagoon Road, 1 mile from boundary.
585	,, ..	7·9	32·7	22·3	14·7	4·4	2·0	2·6	12·5	,,	Walters, Te Pu.
587	,, ..	9·7	34·7	21·9	13·7	4·3	2·1	2·4	10·8	,,	Junction Rotorua and Puwhenua Roads.
593	,, ..	8·0	22·8	23·3	13·0	4·1	2·5	3·8	11·1	1·9	Flat in front of Andrews's, Dudley Road.
T 599	,, ..	5·8	44·9	18·8	14·6	2·9	1·6	1·4	8·5	Trace	Higher slopes, Otane Wainuku.
603	,, ..	3·7	36·3	24·8	16·9	3·6	2·0	2·2	9·3	,,	Forest, junction of Rotorua–Tauranga and Mangatoi Roads.
609	,, ..	5·4	35·8	19·5	13·8	4·1	0·6	7·9	10·1	,,	Butcher's, Whataroa Road.
611	,, ..	6·2	34·0	22·0	15·8	5·1	1·1	4·4	9·8	5·3	Koromiko clearing, Whataroa Road.
613	,, ..	6·1	29·5	25·3	14·3	3·9	0·8	8·5	10·5	3·5	Young's, Tauranga–Rotorua Road, Te Pu.
617	,, ..	12·0	31·1	21·4	15·1	4·7	1·5	2·7	11·4	7·4	Fern Flat, Fairlie's, Kaharoa Road.
621	,, ..	12·5	34·8	19·2	15·8	4·9	1·4	1·8	8·9	10·9	Unsworth, Kaharoa.
628	,, ..	7·4	25·3	23·5	11·0	4·9	1·7	16·8	10·9	2·9	Rangi Douglas, Te Waerenga Road.
W 63	,, ..	5·10	22·13	27·78	20·27	8·06	3·01	2·66	9·62	20·0	Lake terrace, Lake Okareka.

	67	,,	..	5·58	35·07	24·19	17·71	5·38	1·50	2·50	7·16	9·7	Mokoia Island, 1,000–1,300 ft.
	87	,,	..	4·64	33·82	25·38	13·45	4·76	2·0	2·8	10·9	Trace	Taken from Whitaroa clearing.
	89	,,	..	6·55	34·71	20·57	12·91	5·50	1·70	3·7	11·5	,,	Matai Road, near above sample, 1 mile from main road.
	631A	,,	..	7·8	64·6	13·1	6·5	3·6	1·1	0·8	3·4	38·6	Rotoiti S.D.

Sandy Silts.

S	455	Sandy silt	..	..	0·40	22·91	26·88	18·15	4·39	2·3	6·22	13·64	Trace	C. Hemmings, Mamaku.
	463	,,	..	..	0·45	24·9	30·3	18·2	4·6	1·55	5·4	12·98	,,	Steeles' old mill, Lichfield Road.
	479	,,	..	..	1·45	33·76	24·80	17·26	4·83	1·2	31·96	11·16	2·3	Belmont Estate.
	505	,,	..	..	1·54	24·23	22·46	17·98	5·97	4·0	10·90	14·34	Trace	Hemmings', Mamaku.
	664	,,	..	..	0·45	19·13	26·56	22·17	7·78	2·2	6·80	12·54	,,	Beech forest area, Steele's mill.
	666	,,	..	..	0·50	24·67	28·35	21·76	5·88	1·0	3·6	11·44	,,	Pasture between Steele's old mill and Waihi Company.
T	506	,,	..	..	2·25	29·92	29·88	16·92	5·69	1·0	3·28	9·60	4·3	Hunt and Wrigley, 3E, Sections No. 4 and No. 3B, Block 4, Horohoro S.D.
T	508	,,	..	..	1·79	29·30	27·24	19·70	5·51	2·10	3·06	9·20	Trace	Neville, No. 2M and 3C, 2A, Block 4, Horohoro S.D.
	514	,,	..	..	2·80	27·60	26·64	21·0	6·30	0·80	2·70	10·64	,,	G. Grace, No. 1M, No. 3, Block 4, Horohoro S.D.
	520	,,	..	..	0·6	33·3	27·9	16·0	4·3	1·5	3·5	10·2	,,	Philsen, flat near bridge, Mamaku Plain Road.
	522	,,	..	..	1·4	31·8	29·0	14·3	4·3	0·9	4·4	11·3	,,	Danzig, Mamaku–Rotorua Road.
	526	,,	..	..	1·00	25·64	28·55	12·87	7·51	2·46	8·10	14·10	,,	Section 12, Block 14, Mamaku-Rotorua Road.
	530	,,	..	..	9·9	27·1	26·7	16·8	3·8	0·8	2·7	10·8	11·1	Turner's change paddocks, Hamurana.
	536	,,	..	..	0·71	26·21	29·10	14·89	8·44	3·0	3·16	12·84	Trace	Mrs. Bullock, Mamaku (blind road), Section 1, Block 13, Rotorua.
	538	,,	..	..	0·46	23·22	28·40	11·74	6·53	2·30	13·84	15·08	,,	Section 1, Block 14, Rotorua, ¾ mile nearer Mamaku than above.
	540	,,	..	..	0·76	20·82	28·62	13·08	7·32	3·0	12·24	14·16	,,	Section 1, Block 10, Rotorua, Mamaku–Oxford Road.
T	542	,,	..	..	0·6	24·5	31·7	17·3	4·9	1·9	4·0	13·4	,,	Martin, Tirau–Rotorua Road.
	544	,,	..	..	1·3	25·1	31·3	18·0	5·1	1·3	4·2	12·1	,,	1 mile west from Tarukenga Station.
	546	,,	..	..	1·6	25·7	29·4	20·9	4·8	1·0	3·3	11·1	2·3	Hampson, beside Tarukenga Station.
	555	,,	..	..	1·3	28·8	28·5	16·7	3·9	0·7	7·2	11·4	Trace	Middle terrace, 1,425 ft., Section 4, Block 4H.
	557	,,	..	..	1·4	26·7	31·9	16·4	3·5	0·5	6·6	11·8	,,	Highest ridge, 1,675 ft., Section 4, Block H.
	559	,,	..	..	1·1	26·0	27·5	15·8	4·4	1·3	9·4	13·0	,,	Highest terrace, forest 1,500 ft., Section 3E 1, Block 4.
	561	,,	..	..	2·3	38·4	27·3	16·1	3·7	0·8	2·4	7·9	Trace	Grassy flat, No. 4, Block 4, Horohoro.
	573	,,	..	..	5·9	28·9	24·8	17 5	3·6	2·6	2·3	12·8	,,	Forest, junction Rotorua and Roy Roads.
	575	,,	..	..	4·1	25·7	27·2	21·0	4·6	2·1	1·7	12·1	1·9	Maden's flat, Roy Road.
	577	,,	..	..	4·9	28·3	25·9	16·3	4·1	2·6	3·1	13·8	Trace	Catley's, junction Roy and Lagoon Roads.
	581	,,	..	..	7·7	31·7	22·5	14·0	4·7	3·3	2·3	12·7	,,	Oakley's, Lagoon Road.
	591	,,	..	..	3·1	29·9	25·7	15·7	4·3	2·6	2·7	14·1	,,	Forest, Puwhenua Road.
	595	,,	..	..	6·5	38·0	17·5	16·1	5·8	2·3	2·7	10·0	3·7	Mosich, Mangatoi Road.

MECHANICAL ANALYSIS OF SUBSOILS, ROTORUA COUNTY (NORTHERN PART)—*continued.*

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Location.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.		
597	Sandy silt	2·7	31·3	25·3	15·7	4·8	2·2	2·6	14·0	Trace	Lower slopes, Otane Wainuku.
615	,, ...	7·4	26·0	23·4	16·0	4·6	1·1	6·3	13·2	5·0	Fern slopes, Tauranga–Rotorua Road.
W 284	,, ...	4·2	30·0	26·2	20·5	5·8	1·5	3·1	6·7	2·0	Close to Whakarewarewa, in eucalypt forest, Tarawera Block 1.
W 286	, ...	4·6	32·7	28·7	17·4	4·0	1·1	3·4	6·9	1·9	Hill above Whakarewarewa, opposite Block 10, Tarawera 4 Block.
					Fine Gravelly Sands.						
R 882	Fine gravelly sand ..	22·1	36·1	13·9	10·4	7·2	2·0	1·1	6·6	23·3	Virgin fern country, Mourea.
1109	,, ..	17·3	43·2	10·3	9·4	4·4	2·3	2·8	10·6	4·8	Sander's, Rotoiti S.D.
1135	,, ..	22·0	38·9	13·8	11·0	4·5	0·7	1·9	7·3	12·0	Lichenstein and Arnoldson's, fern slopes.
S 499	,, ..	22·5	41·5	12·0	10·8	4·4	1·4	1·2	5·0	20·0	Rotoiti S.D., on ridge.
502	,, ..	17·73	47·08	11·13	12·07	3·6	0·9	1·7	5·38	19·5	Rotoiti S.D., slopes of gullies.
T 176	,, ..	21·47	53·36	7·49	5·37	3·78	1·1	1·30	5·08	11·8	Rotoiti S.D., Blocks 7 and 8.
W 83	,, ..	17·28	55·38	12·37	6·64	3·64	0·90	0·52	3·12	8·8	Sample taken in rimu-tawa forest below Rotoiti Block 16, Section 6.
85	,, ..	18·91	52·52	11·37	8·32	2·56	0·10	1·0	4·7	5·8	Open fern land, twelve miles from Okere. Top end eight miles from main road, opposite Scenic Reserve.
73	,, ..	18·68	45·43	13·28	11·22	4·18	1·90	0·98	3·90	25·0	S. A. Pettybridge, Tikitere, ploughed paddock.
75	,, ..	17·17	50·88	12·54	8·78	4·26	2·00	0·74	3·64	16·1	Rimu-rata-pukatea-tawa forest, two miles from Okataina, 1,245 ft.
420	,, ..	18·33	47·99	10·95	10·07	3·54	1·0	2·2	6·4	19·6	Two miles south from Rotoiti, hillside, Rotoiti Block 12.
628A	,, ..	25·3	38·9	17·9	8·4	6·4	1·2	0·7	1·3	80·0	Ruawahia, Block 3.
632A	,, ..	21·6	62·0	6·1	3·8	3·5	1·0	c·6	2·0	25·0	Rotoiti, Block 16.
					Coarse Sands.						
T 174	Coarse sand	14·83	42·95	14·26	12·45	4·87	1·6	2·0	5·08	10·8	Blocks 7 and 8, Rotoiti S.D.
W 77	,, ...	10·89	61·97	14·11	6·27	3·30	0·30	0·36	2·02	9·8	Rimu-tawa forest, Hongi's Track.
					Sandy Loams.						
W 447	Sandy loam	9·1	13·1	28·9	21·5	13·2	7·8	1·3	4·9	19·4	Between Lake Okataina and Gee's, Tarawera Block 3
W 449	,, ...	7·5	21·9	30·2	30·0	10·2	5·1	0·9	3·8	20·9	Block 3, Tarawera, between Lake Okataina and Okareka.

air, into which the particles were blown by a series of volcanic explosions. The particles in the greater area fell on tablelands and areas which were not subject to river-action; hence any weathering of the volcanic dust, &c., must have been accomplished merely by percolating rainwater, and the deposit was coarse enough to resist this action to a considerable extent. Thus both soils and subsoils now exist in a coarse-grained state, containing very little clay or silt—the fractions of a soil which contribute towards fineness of texture, water-holding power, and consequently fertility.

It is very necessary that such work as this should be performed in the most painstaking and thorough manner possible. The surveyor and his assistant, tramping over the country, collect samples by boring into the ground and carefully drawing cores from different depths. When the land has been cultivated or even sown in grass the work is laborious, but when forest or fern cover the terrain the task is much more difficult. The constancy to type which the tabulated figures prove exists over large areas is evidently due to extremely similar conditions operating over an extended period of time. It is no function of the soil chemist or surveyor to explain in detail how the different strata became deposited in their present position, and why in one place coarse- and in another fine-textured soils occur. Their occurrence may not square with current geological speculations, but, if so, it may be justly argued, so much the worse for the speculator, for the soil surveyor can affirm confidently that such soils do occur and in approximately the areas and situations stated. In support thereof the figures are given from which the maps are plotted.

(To be continued.)

PLANT SPECIMENS FOR IDENTIFICATION.

THE following information is embodied in a circular issued by the Director of the Fields Division, and is commended to the attention of farmers and others forwarding specimens:—

Plants sent in for identification should be as complete as possible and include a portion of the roots. More than one specimen should always be sent if possible, and ripe seeds, when available, should be enclosed in a separate envelope. Two methods of packing are suitable, as under:—

(1) Wrap root and lower part of stem in *slightly* damp moss or several layers of damp newspaper; tie this wrapping on securely; lay plants in tin or box with loose paper, if necessary, to prevent undue shaking, and make airtight before enclosing in wrapper for posting. Plants should be cut only when absolutely necessary for package of reasonable size to be made.

(2) Lay each plant, spread out and as far as possible without parts overlapping, on about five thicknesses of newspaper; cover with final layer of several thicknesses, and tie flat between cardboard covers before wrapping for post.

The label, which should be preferably attached to the plants, should give particulars of growing-place of plant (such as pasture, turnip-field, wayside, &c.) and date of collecting.

Where the plant has no flowers always use the first method of packing, and leave plenty of the root-system attached so that the plant may be grown on to maturity if necessary. On no account simply wrap specimens up loosely in a single paper cover. Either of the proper methods entails no great labour, and greatly facilitates identification. Where the plants have to travel any great distance they should be sent by express transit.

Packages should be addressed to the Botanist, Plant Research Station, P.O. Box 240, Palmerston North.

THE LAMB MORTALITY INVESTIGATION.

NOTE ON THE 1928 SEASON'S WORK.

D. A. GILL, M.R.C.V.S., D.V.S.M., Assistant Officer in Charge, Wallaceville Veterinary Laboratory.

THE investigation commenced in 1926 in Central Otago concerning the mortality among lambs about two to six weeks old was continued in the Maniototo and adjacent districts last spring. On this occasion the work was confined to the technical aspect of the question, and for this reason no detailed report will be published. This general note on the work of the 1928 season, however, will apprise the farming community that the investigation is not being allowed to lapse in any way.

The main line of investigation was concerned with the possible presence in the bowel of affected lambs of certain types of organisms which might induce the condition in question through producing an unusually large amount of toxins. No definite evidence of this was obtained, nor could any likely germs be discovered in the blood, cerebro-spinal fluid, or various organs. The work on the flora of the intestine is exceedingly difficult, and suitable cases are hard to find, but further intensive work on these lines has been planned for the future. Specimens were also obtained for use in various biochemical tests.

The most probable train of events, culminating in the death of the lambs, seems to be that the condition is due to toxins which are formed in, and absorbed from, the gut; that these toxins may be produced in the gut by bacteria which are common and constant inhabitants of the gut, and which normally lead a quite harmless existence there; that through some factor or factors connected with the diet these bacteria have been enabled to increase in numbers and to produce larger quantities, or possibly more powerful types, of toxins. This by no means precludes the possibility that such organisms may have simultaneously increased in virulence so that they now attack types of lambs that were previously immune.

It will be seen from this that while the writer is not in full agreement with what is popularly understood as the "overnutrition theory" he does consider that at rock-bottom some dietary fault is responsible for the mortality.

In addition to the above-mentioned work a large series of preventive experiments with the use of various mineral-lick mixtures was carried out, but no definitely beneficial effects were noted so far as the mortality was concerned. It may be also recorded that in several further cases where it was tried the preventive method of yarding for twenty-four hours every five to seven days gave good results, as it may be expected to do in all cases provided it can be properly and systematically carried out. Details of this method and other preventive measures were given in the *Journal* for March, 1928, pages 149–152.

An extensive programme of work for next season has been planned out, embracing preventive experiments as well as further investigations aimed at clearing up the true nature of the disease.

LOSSES OF YOUNG STRAWBERRY-PLANTS.

INVESTIGATION IN AUCKLAND SUBURBAN DISTRICT.

W. H. RICE, Orchard Instructor, Horticulture Division, Auckland.

DURING December, 1926, the attention of the Horticulture Division was called to the loss of some 150,000 strawberry-plants in the Auckland suburban district, due to non-establishment after planting. A preliminary survey showed that nine plantations were affected to variable degrees, the greatest individual loss being 40,000 plants. All these plantations were situated in the Northcote area, a district noted for the successful cultivation of strawberries since 1887. Local information went to show that the trouble had been first noted in 1921, in one plantation; in 1924 it was observed in three plantations, and in 1925 in six plantations. Strawberry-growers of this locality were very alarmed at the spread of what was termed a "mystery" disease, particularly as such a trouble was not known in the other strawberry-growing areas of the district.

The plants were first-year transplants set out in May, and under normal conditions should have made good root-action without any great development of foliage during winter. With the first period of open weather, usually during October, rapid growth takes place with normal plants, while in certain areas others will die which up to this time have been to all outward appearances identical. When lifted these plants were found to have made no root-action since planting, having evidently been kept in a green state by atmospheric moisture, and rapidly died under evaporation. This mortality continued to manifest itself, plants dying out according to the lack of roots made. If there were sufficient roots to maintain life the plants made new ones from the crown and grew quite well, though too late to be of commercial value. There was also a class of plant which had made some root, but which had died back, usually from the tip, as though the soil conditions had once been correct but later had become uncongenial.

Specimens were forwarded to Wellington for biological examination, and, no pathogen being found to account for the mortality, it was decided to carry out cultural experiments co-operatively with Mr. J. B. Tonar and the investigation committee of the Strawberry Growers' Association, Messrs. T. M. Shepherd, R. F. Kay, E. C. Walton, and S. Knight.

Factors which had to be considered as possibly contributing to the local trouble, and which were investigated during 1926, 1927, and 1928, comprised disease, manure burn, toxic soil conditions, physical condition of the soil, and drainage.

Disease.—Though laboratory investigation had failed to disclose any specific disease, it was suggested by some growers that bacterial infection was present and transmitted from one plantation to others through using common implements. This was not substantiated, and the reverse was demonstrated by one plantation which had no loss, although ploughed and cultivated during two seasons with the implements used alternatively on an area showing the greatest loss. Investigations were

extended to the plant-nurseries, but no trace of the trouble could be found there. Disease-transmission by plants was negatived by the fact that plants from many and the same sources were found equally on plantations with no loss and on areas subject to considerable loss. It was impossible to reconcile the loss of plants with some undetermined disease, as plants which had all but succumbed to the trouble were moved to very light land and, though subjected to no treatment, fully recovered and made robust plants in the succeeding seasons.

Manure Burn.—The non-established root-system on affected plants was consistent with injury such as might be expected from recently applied artificial fertilizers. This could be further expected in that there is a tendency to apply such dressings to excess. As an example, it may be stated that a fair representation of the average dressing used generally throughout the district, and which has been applied annually for the past twelve years to one piece of land, is as follows: Ten days prior to planting, 5 cwt. blood-and-bone, 5 cwt. super (40–46 per cent.), 5 cwt. bonedust, 2 cwt. sulphate of potash; at time of cultivation (two at 4 cwt. each), 8 cwt. blood-and-bone; prior to mulch, 4 cwt. Peruvian guano: total, 1 ton 9 cwt. per acre from May to October.

Experimental dressings were made at various intervals prior to planting, but none of these influenced the degree of mortality under investigation, though application at the time of planting did injure the root-system. Quarter weights of the quantities of fertilizers specified gave better crop results.

Toxic Soil Conditions.—Many areas had been cropped with strawberries continually up to twenty-five years, during which time no rotational or green cover-crops to turn in had been grown. One plantation on which paspalum luxuriated in the off-season had never recorded the mortality, though situated next to the area on which the greatest loss had been experienced but on which no humus has been turned in for several years. To test the effect of soil-dressings, sulphate of iron, sulphate of copper, and sulphur, all at 3 cwt. per acre, were tried. The only variation noted, however, was greater luxuriance on the sulphur-treated land.

Physical Condition of Soil.—On the whole of the affected areas this was poor. The land is of a very heavy loam on dense clay subsoil, prohibiting any but very local effects of drains. This is intensified by lack of humus, and the excessive compacted condition due to non-rotation of crops and the heavy dressings of artificial fertilizers. There is also a local aversion to the use of lime for the strawberry crop, as growers endeavour to keep the land as acid as possible. Improvement of the physical condition of the soil by the use of green-manuring crops has been shown during the investigations to be of some importance, as the land has become of a texture that is difficult to drain, and under seasons of heavy rainfall rapidly becomes waterlogged.

Drainage.—Wherever loss was investigated it was always found associated with soil-saturation of extended duration. A factor influencing this condition is lack of drainage. Under-drainage is not practised to the extent it deserves; the beds are plotted out and surrounded by a surface drain, which, while it may trap water from a higher level, nearly always fails to carry away surplus surface water. It has been the practice when cutting these surface drains to open them up to a

depth of 12 in. and level back the soil only a short distance on to the beds, thus creating a central depression, and it is not uncommon to find that when the drains would be most useful they have silted up so as to be useless. There is also to be found, usually on hillsides, a class of land which has a hard-pan, causing excess moisture to come to the surface where the landfall is apparently good. This outcrop of water usually occurs where the land is patchy, and on the more loamy parts where one might think drainage would be good.

Repeated surveys of the affected plantations and experimental plantings disclosed the fact that where the land was elevated or depressed by faulty levelling prior to planting, the drier and more elevated parts grew good plants, while in the depressions and away from the influence of drainage the mortality was greatest. Further, on a new plantation in strawberries for the first time, and on soil of good physical condition, it was found where a tile drain was blocked that mortality was induced, progressive according to excess saturation near the drain bad and radiating outwards to nil. Though the mortality was never found except associated with excess water, instances have been noted of temporary excess water with no mortality. During the investigations one area only came under notice where non-establishment of plants could not be traced to a waterlogged condition of the soil, but on this area plants died out uniformly in rows on elevations as well as depressions, and the line of demarcation was acute between an area on which 30-per-cent. potash manure had been used ten days previously (the excessive salt of which apparently caused the mortality) and an area of good plants not so treated.

CONCLUSION.

Working on these deductions, recommendations were made to growers which called for green-manuring crops, adequate underdrainage, and avoidance of depressions on the surface level. Where these measures were put into operation they proved successful in the 1928–29 season. On one area of 35,000 plants, where the land was tile-drained and a crop of green oats turned under, with the usual programme of manures, the loss of plants due to the mortality under investigation was only three dozen, whereas in the previous season on the same land from a similar number of plants three thousand were lost. On another wet corner of a plantation where the mortality had been severe for two seasons, better drainage resulted in no loss being experienced in 1928–29.

Feeding of Calves.—It is a well-recognized fact in feeding economy, and amply illustrated in the case of countries specializing in baby-beef production, that a young animal will give a better return per pound of food eaten than an older animal, all other factors being equal. Reasoning on these lines, the store stage in an animal's life should if possible be eliminated and the young animal kept in a vigorous growing state right throughout. In our beef-producing herds where the calves are mother-reared, and when they are weaned under suitable feed conditions, there is no trouble from internal parasites. It is specially important in dairying districts where the heifer calves are reared that special attention should be paid to their feeding throughout the first year of growth.—*Live-stock Division.*

SOME COMMON AILMENTS OF PIGS.

D. MARSHALL, M.R.C.V.S., Veterinarian, Live-stock Division, Hamilton.

PIGS are very frequently kept under conditions which are far from natural. If numbers are herded together, yards become fouled and muddy, and disease, if it occurs, is more likely to spread. The following notes aim at giving practical points of advice to farmers in the diagnosis and treatment or prevention of some of the common troubles.

DIARRHŒA OR WHITE SCOUR.

Young suckers may be affected with a form of diarrhœa or white scour, which frequently results in death within two to three days, while those which survive suffer considerable check. One apparent cause is too generous feeding of the sow just before and just after farrowing. While the diet should be sufficient and varied, with a due proportion of flesh and bone-forming elements, it should not contain excess of protein substances such as meat or heavy meals.

The remedy is to reduce such foods or omit them from the sow's diet for ten days preceding and three to four days after farrowing. The provision for the pregnant sow of uncooked green food, for which the best is pasture grazing, has been found helpful. The addition of potassium iodide in the daily slop will have a beneficial effect on the unborn young. For pregnant sows a tablespoonful daily of a solution of 1 oz. of potassium iodide in 1 gallon of water will be sufficient.

As such outbreaks of diarrhœa may take on a contagious nature, cleanliness of the sties for the little pigs, with thorough disinfection of farrowing-pens for each successive litter, should be practised.

SORES.

Weaners and slips are very frequently affected by sores, which occur on any part of the body, but most often on the forehead, jaws, and shoulders. These vary in size from a shilling-piece up to 6 in. or 8 in. in diameter. They are slow to heal, and usually there remains a blemish, which, after slaughter, renders necessary the condemnation of the affected part. Where the pastern or foot is affected severe lameness may result.

The cause is the infection of small wounds by a dirt germ which is widely distributed in the soil, and which on entering such wounds multiplies and causes the death of surrounding tissue. Wounds may be caused in various ways, but from the common site of these sores on the face, jaws, and shoulders it is evident that the barbed wire generally used in the construction of pig-yards plays an important part. It has been observed that where netting and plain wire are substituted for barbed wire such cases seldom occur.

A close watch should be kept for these sores in the early stages, and at their first appearance they should be dressed with tincture of iodine until they dry up. Quicklime should be dusted round the feeding-places, and it is a great advantage to have the troughs on a raised wooden platform or grating, which provides better drainage. Pigs might be kept off the barbed wire to a certain extent by running a board along the bottom of the fence at any spot where they are inclined to nose through.

PARALYSIS OF HIND QUARTERS.

Apart from actual poisoning and parasites, pigs do not appear to suffer to any extent from digestive disease, but may show indirect results of defects in diet. One such effect is evidenced by paralysis in young growing pigs three to four months old. The affected pigs show loss of power in the hind quarters, and may move about on their fore legs, trailing the hind quarters on the ground. This affection is probably due to a failure to assimilate calcium phosphate from the food, and may be cured in three to four weeks, or prevented by adding a little cod-liver oil to the ration daily, or by giving a more varied diet, including a little new milk and green stuff, particularly clovers, with a small daily allowance of steamed bone-meal.

PLEURISY AND PNEUMONIA.

Many pigs after slaughter show lesions of pleurisy, which may be recent or old-standing and healed. It is doubtful if this causes any marked symptoms during life.

Pneumonia is frequent, and is evidenced by distinct signs of dullness and weakness, unwillingness to feed, cough, nasal discharge, and heaving at the flanks. While all forms should be regarded as contagious, some are markedly so, and spread quickly after the introduction into the herd of bought pigs suffering from the disease. Cold draughts are frequently a predisposing cause, and it has been observed that pigs lying under open-bottomed hedges through which cold winds blow suffer more often than those in open yards.

Little can be done in the treatment of pneumonia. Diseased pigs should be isolated as soon as observed. Where the outbreak persists, it is sometimes necessary to clear out all the pigs, plough up and lime yards, and disinfect sheds or build new ones in a fresh spot. Fresh lines of bought pigs should be kept apart from the general herd for a fortnight, until they are seen to be healthy.

TUBERCULOSIS.

It is rather unfortunate, from the point of view of impressing its importance on the farmer, that tuberculosis in pigs very seldom causes any noticeable symptoms. It is by far the most frequent cause for condemnation of pigs in the various bacon-factories and abattoirs, and it is astonishing to what extent the disease may sometimes be found present in a fat and apparently healthy pig.

Once in a while an aged sow may show definite symptoms — poor condition, cough, and enlargement of the udder. While coughs in pigs are nearly always the result of one of the forms of pneumonia of a non-tuberculous nature, any enlargement about the mammary gland should be regarded with suspicion, as such enlargements are frequently tuberculous, and if so are a very grave danger to the suckling litter, which is certain to become infected.

Tuberculosis in the slaughtered pig may be recognized by the presence in the lymphatic glands about the throat region and elsewhere of white cheesy areas, and, in the worst cases, of similar nodules scattered throughout the lungs and liver and on the inner surface of the ribs.

In New Zealand tuberculosis in swine is believed to be nearly always due to infection by the bovine type of organism: that is to say, it is contracted from cows, and most probably from the milk. Where dairy-factory by-products, such as buttermilk, have been subjected at some stage to efficient pasteurization no danger exists in their use for pig-feeding. Where home separation of milk is in vogue, however, it may easily be seen how one cow liberating germs of tuberculosis with the milk may contaminate all the separated milk and infect pigs fed on it. Further, once the infection gains a footing in the yards and sties the soil and litter become contaminated, and remain a source of danger to successive crops of pigs.

The disease may be also contracted by pigs grazing in a field which is infected by the dung or discharges from a tuberculous cow. In the United States it has been found that a considerable proportion of tuberculosis of swine is due to the avian type of baccillus. While this has not been found to any extent in New Zealand, the presence of tuberculosis among poultry should always be regarded as a possible danger to pigs.

Methods of control are indicated by what has already been said. In the event of tuberculosis being found to any extent among pigs after slaughter, the feeding methods on the farm should be examined. If raw home-separated milk is being fed the dairy herd should be carefully scrutinized. Sties should be thoroughly cleaned and whitewashed, feeding-places and troughs cleaned, and contaminated yards turned over or shut up for a spell. Any sow with suspicious chronic enlargement or hardness about the mammary gland should be got rid of.

OFFICIAL GRADING OF NEW ZEALAND EXPORT BUTTER IN STORE AT AUCKLAND.

[*Photo by H. Drake.*

LUCERNE A LIME-RICH PLANT.

ANALYSES OF OTAGO SAMPLES.

B. C. ASTON, Chief Chemist, Department of Agriculture, Wellington.

A SUGGESTION was made in the issue of this *Journal* for September last (page 151) for growing on lime-depleted soils, where the pasture shows signs of calcium deficiency, perennial and deep-rooted plants, such as legumes, which are usually characterized by having a high calcium content compared with the species of Gramineae, the family to which all the grasses belong. To what extent the calcium of the natural ration could be supplemented by such means is now a matter of inquiry.

The first plant to suggest itself was naturally lucerne, or alfalfa, that king of green-fodder plants. Lucerne is, however, a plant which loves a dry climate, and the King Country—the district with which the *Journal* article dealt—has an excessively moist climate, especially at an elevation of 1,000 ft. in the vicinity of Te Kuiti. Lucerne also loves a calcareous subsoil, and here is pure limestone, although buried under some feet of volcanic dust or mud. The matter is evidently one for experiment, for it is quite possible that the expense of establishing the lucerne in the particular area (Mairoa) where it is most desired to grow it would not warrant employing it in competition with red clover, which gives good results there when well manured. It is to be noted, however, that lucerne under favourable conditions will yield in a season treble the weight of fodder supplied by red clover. There are other legumes which might be mentioned, but consideration of these must be deferred to another article. The aim of the present article is to show the paramount position that lucerne occupies as a medium for supplying a supplementary food of very high nutritive value and containing a high amount of calcium, an amount which under favourable conditions may amount to six times the quantity to be found in the dry matter of the poor hill pasture. It is well established that lucerne, in addition to being an excellent food, exercises a specially good influence on the health of stock.

It must be premised that the samples of which the analyses are given in the accompanying tabular statement are from samples collected in Otago by Mr. C. M. Wright in October and November, 1927, and February, 1928, and that this part of New Zealand has proved to be eminently suited for the growth of lucerne. The amounts given for calcium are exceptionally high, but the writer has the greatest confidence in the accuracy of the results. Each sample was done in duplicate by Miss E. B. Kidson and Miss R. Strand, assistant analysts of this Department's Chemical Laboratory staff, and the results of both determinations, the mean of which is adopted here, agree well with each other.

It is hoped to obtain further samples of lucerne grown under less favourable conditions than those obtaining in Otago, and of other plants more likely to succeed in the moist climate and calcium-deficient soils occurring over so much of the North Island.

Von Wolff's analysis (quoted by Hopkins) of alfalfa (this being the name always used in the United States and other parts of America) shows that lucerne contains 3·28 per cent. of calcium oxide (lime), and

Chemical Analyses of Lucerne Samples from Otago.

Results are percentages calculated on the water-free sample.

Lab. No.	Locality.	Date collected.	Ash.	Crude Silica (SiO_2).	Iron Oxide (Fe_2O_3).	Phosphoric Anhydride (P_2O_5).	Calcium Oxide (CaO).	Magnesium Oxide (MgO).	Manganese Oxide (Mn_3O_4).	Chlorine (Cl).	Nitrogen.	Sulphuric Anhydride (SO_3).	Manurial Treatment.
8005	Gimmerburn	10/27	12·63	0·47	0·028	1·46	2·63	0·88	0·0075	..	..	..	
8013	Ranfurly	10/27	14·56	0·57	0·036	1·44	3·42	0·59	0·0079	..	..	..	1925, 7 cwt. limestone and 1 cwt. super per acre.
8014	Ranfurly	10/27	12·02	0·37	0·035	1·26	2·65	0·89	0·0077	..	..	..	Special lucerne manure and super.
8018	Oamaru	10/27	12·95	0·51	0·038	1·39	3·66	0·64	0·0089	..	..	..	
8019	Ngapara	10/27	12·54	0·56	0·0099	1·26	3·46	0·58	0·0061	..	..	..	
8021	Gimmerburn	11/27	12·94	1·19	0·038	1·13	2·51	0·96	0·0065	..	..	..	
8023	Patearoa	11/27	13·41	0·37	0·021	1·23	3·82	1·05	0·0140	..	..	..	
8024	Patearoa	11/27	12·88	0·27	0·019	1·00	3·04	1·04	0·0100	..	..	..	
8026	Ida Valley	11/27	15·43	1·50	0·054	0·90	3·72	0·07	0·0110	..	3·60	..	Sown 1926 with 6 cwt. ground limestone per acre.
8027	Ida Valley	11/27	13·68	0·17	0·017	1·12	3·93	0·66	0·0080	..	..	..	1925, 2 cwt. super per acre; 1927, 6 cwt. limestone per acre.
8028	Gimmerburn	11/27	15·70	1·31	0·043	1·26	3·58	1·20	0·0090	..	..	..	
8029	Gimmerburn	11/27	13·66	0·87	0·027	0·91	3·42	0·93	0·0130	1·10	..	..	No manure.
8032	Wedderburn	10/27	14·85	0·61	0·032	1·35	4·09	1·09	0·0150	0·40	..	1·21	Sown with 4 cwt. limestone and 1 cwt. super per acre each year.
8035	Wedderburn	11/27	14·06	0·79	0·038	1·35	3·13	0·89	0·0130	0·29	..	1·13	Ditto.
8037	Kokonga	11/27	12·62	0·33	0·021	0·90	4·26	0·53	0·0046	..	4·70	1·09	1926, 2 cwt. super per acre.
8038	Ranfurly	11/27	14·07	0·36	0·020	0·93	3·49	0·60	0·0049	..	..	0·64	
8039	Gimmerburn	11/27	13·60	0·90	0·032	0·83	3·26	0·84	0·0062	..	3·05	1·33	
8040	Gimmerburn	11/27	11·80	0·31	0·019	1·15	3·03	0·63	0·0043	..	5·28	0·87	
8041	Oturehua	11/27	14·54	1·07	0·041	1·46	2·74	0·68	0·0086	..	..	1·29	1922, 7 cwt. limestone per acre and special lucerne manure; 1924, 3 cwt. super per acre; 1925, 2 cwt. super per acre; 1926, 1¾ cwt. super per acre.
8044	Ranfurly	2/28	14·04	0·62	0·023	1·32	3·22	1·17	0·013	..	5·76	1·07	7 cwt. limestone per acre at sowing: later, 2 cwt. super per acre.
8045	Ranfurly	2/28	14·51	0·50	0·019	1·43	3·09	1·01	0·010	..	5·89	1·28	7 cwt. ground limestone per acre at sowing. No further top-dressing.

NOTE.—The writer has checked the results by duplicate analyses, using a different method for phosphoric anhydride and calcium oxide in the cases of Nos. 8013, 8014, 8018, 8041, 8044, and 8045, and obtained practically identical figures. For alumina the figures he obtained in percentages were: for No. 8013, 0·104; for 8014, 0·084; for 8018, 0·066; for 8041, 0·123; for 8044, 0·064; and for 8045, 0·077. It may be regarded as probable that the samples were contaminated slightly with earthy matter, which would account for the high iron content in most cases.

that when the crop is cut in early bloom lucerne hay contains 3 per cent. of calcium oxide, both calculated on the dry matter; whereas red and white and alsike clover hay contain, according to the same authority, from 1·6 to 2·82 per cent., depending on the stage of growth, and young red clover contains 2·8 per cent., in bud 2·49 per cent., and in flower 2·38 per cent. The general superiority of lucerne as a calcium feeder will be seen from these figures as well as from the analyses of the Otago samples, which latter show an average calcium-oxide content of 3·39 per cent.

THE ECONOMIC SIGNIFICANCE OF SYSTEMATIC BOTANY.

Lecturette by Dr. H. H. ALLAN, Systematic Botanist, New Zealand Plant Research Station, Palmerston North, broadcast from Radio Station 2YA, Wellington.

ONE side of the work of the Plant Research Station deals with the applications of systematic botany, and I propose to speak of one aspect of the investigations being carried out. Systematic botany is that branch of science which deals with the classification of plants according to their relationships. The common-sense observation of mankind long since arrived at a rough classification—rough because essential differences were often overlooked owing to superficial resemblances — and gave names to the classes observed, such as grasses and buttercups, oaks and elms, and what not. But systematic botany endeavours to go deeper than common observation, to disentangle its confusions, to be more precise, and to add experiment to observation. Now, I take it that most systematic botanists engage in this task because it appeals to their natures, just as the philatelist collects stamps and studies perforations and water-marks because he likes so to do. But this must not lead us to suppose that the work has no value except as a hobby. I grant that the extent of the economic value is only beginning to dawn upon us. Until quite recently, for example, botanist and sawmiller alike were content to class together under one name two species of southern-beech, although the timber produced by the one is quite different in quality and uses to that produced by the other.

The horticulturist and the practical plant-breeder have in this matter left the pure botanist far behind in many respects. To Peter Bell, we are told on unimpeachable authority, the yellow primrose by the river's brim was a yellow primrose and nothing more. To the botanist of Peter's day it was even less—it was *Primula vulgaris* and nothing more. Yet the keen-eyed horticulturists saw that there were many distinct forms called by the one name, just as the term "hat" covers a multitude of forms, from that made famous by Charlie Chaplin to the quaint affairs worn by the modern woman. By skilfully exploiting the possibilities offered by the mixed population presented to him by nature, the plant-breeder has produced our modern races of primroses, cowslips, oxslips, and polyanthus. So, too, the common field-daisy is still to most botanists *Bellis perennis* and nothing more. He

passes over, almost with contempt, as trivial variations, those minute differences that have been seized upon by the breeder, and from which have been derived the numerous fine types of daisy that now adorn our garden borders. To the botanist the turnip is still apt to be *Brassica campestris* and little more; whereas to the gardener and the farmer there are the scores of forms of swedes and turnips and rape, with their different characters and uses.

The botanist of the new school, however, is beginning to study, and in part to understand, the causes of the existing diversity within these groups—to assess the status of the forms, and to explain the results the breeder has obtained. He is more and more fully realizing the need for a very minute analysis of the multiformity of nature; and, although he is still at the beginnings, he is already in a position to suggest more accurate methods of procedure—methods that will achieve the ends aimed at with a smaller amount of wasted effort. I may refer to the remarkable work accomplished by Erwin Baur in the snapdragon (antirrhinum) group as an example of what can be done. This worker has produced hundreds of forms of snapdragons, can combine their colours at will, knows their pedigrees, and can accurately predict the behaviour of their offspring.

In thus endeavouring to analyse the situation the modern botanist (and New Zealand botanists, under the inspiring leadership of Dr. Leonard Cockayne, F.R.S., are taking no small share) has developed certain important conceptions, and for the sake of clarity has had to invent a series of terms. And some of these terms are necessary for my argument.

An examination of the individual plants and their behaviour shows that there are to be found groups of individuals all closely resembling one another in many details, and producing offspring exactly resembling themselves. These true-breeding groups we term jordanons. Certain jordanons, while differing constantly in some features, are found to have a number of points in common. These closely related jordanons we speak of as forming compound species. An ordinary field of Hunter's wheat is an example of a compound species, some of the jordanons being better, some worse yielders. One such jordanon of high quality has been isolated by Dr. Hilgendorf, of the Canterbury Agricultural College, and is now well known under the name of College Hunter's. So, too, the common sow-thistles of our gardens are made up of two different compound species, each with a number of jordanons within it. The compound species with non-prickly leaves we call *Sonchus oleraceus*, and the prickly one we call *Sonchus asper;* and to the jordanons, when isolated, we may give further varietal names to distinguish them one from another.

We find, moreover, that these jordanons may hybridize, and that the offspring of the cross are not constant true-breeding forms, but a medley. So we recognize the category of hybrids. Man, being a hybrid, does not have children exactly resembling their parents—a fact that sometimes appears to give the offspring great satisfaction.

Again, we find that the environment has a remarkable effect upon plant-form. Two individuals of the same jordanon, growing under diverse conditions, may so differ in appearance that until we bring

them together under like conditions we may fail to realize their essential identity. The grass known to the farmer as brown-top may, when growing among scrub, become a climbing-plant, looking very different from the same species growing as an ordinary member of pasture. These inconstant environmental forms we call epharmones. All workers with cultivated plants are dealing with epharmones. No matter how excellent may be the jordanon of parsnip, potato, timothy-grass, or lucerne that he is growing, he will not succeed in getting the maximum result unless he provides the environment that will produce the best possible epharmone.

The systematic botanist, then, has as his task the sorting-out of the jordanons of the compound species, so that the plant-breeder and the selectionist may test them and lay hold on those best suited for particular purposes. Each jordanon will have its own special features, whether good or bad. It is no longer sufficient, for example, with perennial rye-grass to recognize such so-called races as "Southland," "Canterbury," "Sandon," Hawke's Bay," "Poverty Bay," "Irish," and so forth, and to charge or pay varying prices according to name. In each group the different jordanons have to be sorted out and their qualities tested—no mean task! It may be that there is lurking in Southland a jordanon that will challenge the very best that Hawke's Bay can offer! We have also to recognize that the different jordanons are apt to hybridize with the jordanons of that other important compound species, Italian rye-grass. It may be that there are among the hybrids forms valuable for the farmer, but it is clear that he needs to know whether the seed he sows is that of a pure strain (a jordanon) of either species, or that of a hybrid mixture.

Compound species after compound species awaits study on these lines. Dr. Yeates, of Massey Agricultural College, for example, is working with one important fibre plant, *Phormium tenax*, a great mixture of jordanons and hybrids of diverse qualities. The Plant Research Station is working at various grasses and clovers.

Nor can weeds be left out of account. Attempts are being made to control some of our weed pests by insect-attack. My views on the prospects of success it is not here necessary to discuss. But it is already clear that for any real progress to be made we shall have to study intensively the systematics of our weed flora -a subject, I may say in passing, that has had but little attention paid to it in the past. It is aimed to control, for instance, St. John's wort, ragwort, and blackberry by these methods. It must be realized that these common names are but group-names for a number of distinct jordanons, coupled with their hybrids. Every housewife knows that blackberries vary enormously in their jam- and pie-making qualities. Will our insects attack "blackberry" in general, or will they discriminate, and attack only certain jordanons, allowing others to go unchecked? That insects are apt to discriminate closely between different food plants is, I understand, a fact. Whether different jordanons of insects can be found to attack different jordanons of plants is a problem I thankfully leave to my entomological colleagues. Science is one and indivisible, and all branches must afford their quota of information for a successful issue to result.

Further, it is not sufficient for us to know that there is growing in various parts of Auckland a weed called "sneezeweed." We have to determine what jordanons are actually present. Some of these in their American home—where we could wish they had stayed—are comparatively harmless, some are more or less seriously poisonous. Of course we may let matters slide till we find that serious loss of stock is or is not being incurred, but it is better to forestall any possible harm if we can. In general, we need to know as early as possible of the occurrence of species not before recorded, as a stitch in time saves many more than nine. There has just been sent to me, for example, a specimen of buffalo-burr, *Solanum rostratum*, an extremely undesirable annual plant from America, which, incidentally, provided the original food of the Colorado potato-beetle.

Now, this means also that the botanist requires definite names for his jordanons. It is often asked, Why use these mysterious, generally cumbrous Latin names, when there are common ones that everybody understands? The trouble is that the common name is so often applied in an extremely loose manner, not merely to different jordanons within a compound species, but to quite different species and genera. A single jordanon may also have a considerable number of different names applied to it. I much prefer the common name "snapdragon" to "antirrhinum" for the well-known garden-flower, but if I want to get a particular form for my garden I need a special name, be it Black Beauty or Snow Queen or Maiden's Blush. In New Zealand we all know what compound species is being referred to when we speak of dodder. But in England that name refers in one part of the country to *Spergula arvensis* (known here variously as spurrey, yar, or devil-weed); in another part of the country to *Cuscuta epithymum* (dodder as we know it); and in still another part *Cuscuta* becomes "hairweed," while *Spergula arvensis* becomes "mountain-flax." Indeed, *Spergula arvensis* rejoices in still other names — beggar-weed, bottle-brush, cowquake, farmers' ruin, toad-flax (to us this is the name for *Linaria vulgaris*), franke, lousy-grass, make-beggar, pick-pocket, pick-purse, poverty weed, sandweed, yarrel, and so on. There are at least eighty names applied to the little, inoffensive, woodland plant *Orchis mascula*, and to how many species the names "sheep's burr" and "devil-weed" have been applied nobody knows. Add to this that a similar confusion applies to the common names used in other countries and in other languages, and it is clear that the common name can have no sort of international currency. But the botanist the world over will know what I mean if I ask for *Spergula arvensis*, and I may get particular jordanons to compare with ours—say, variety *maxima* from Denmark, *nana* from the Channel Islands, and *sativa* from Asia Minor.

I do not mean to say that all is as yet plain sailing, nor to deny that the botanist, in his efforts to obtain definiteness and uniformity of usage, appears often to make confusion worse confounded by his name-changing propensities. It comes hard, for instance, after so many years, to be asked to call by the name *Metrosideros excelsa* what was familiar as *Metrosideros tomentosa*, and the unambiguous and beautiful name "pohutukawa" seems much preferable, if we forget for the moment that few outside of New Zealand will have any knowledge of

that name. But on the whole, and despite certain temporary inconveniences, matters are being gradually straightened out. Think for a moment of the confusion nd monetary loss caused by the tangled-up nature of our popular names for the different species of southern-beech in New Zealand, with their different timber-values. Think of the ease and advantage if we could bring it about that the names red-beech or silver-beech should always be applied to one species and one species only. The blue lupin is well known in Australia as a valuable sheep-feed; the blue lupin is well known in New Zealand as a green-manure plant of value. But the blue lupin of New Zealand is *Lupinus angustifolius*, and that of Australia is *Lupinus hirsutus*. The Australian farmer is naturally going to be disappointed if, obtaining seed of blue lupin from New Zealand, he expects to get the species he has learnt to value as a sheep-feed. So too with canary-grass, it is important to know whether you are getting the perennial valuable *Phalaris bulbosa* or the annual worthless *Phalaris minor*. Mr. Johannes Andersen has done good service in this direction by collecting the popular names applied to our native plants and recommending particular ones for adoption. It cannot be gainsaid that it is of great economic importance that we have accurate names for our plants.

In conclusion, I wish to refer to the work of identification of plants attempted at the Plant Research Station. There have been recorded and described over 120,000 species of flowering-plants for the world, and the number of garden forms is legion. Although the majority of plants sent into us are more or less familiar and easy of naming in a general way, it cannot be expected that a few small heads can carry all the knowledge that may be required. Nor is the literature as yet available to us sufficient for all our needs. We ask, then, that those seeking our help will recognize, especially with garden-plants, that much labour is sometimes required in tracking down the specimens. Our work would be materially lightened, and its effectiveness considerably increased, if those sending in plants for identification would endeavour to forward as carefully prepared and as full material as possible, showing all parts, especially the foliage and flowering-parts.

Sometimes we receive fragments that look like badly cured tea; sometimes a mass that looks like a poor attempt at ensilage-making. A little care at the sending end would obviate this. We should not then be in the position in which we occasionally find ourselves, of trying to do what is equivalent to determining a particular breed of dog from a couple of hairs plucked from his tail!

NOTE.—Detailed instructions for the packing and forwarding of plant specimens for identification will be found on page 389 of this issue of the *Journal*.—ED.

Sphagnum Moss.—In certain low-lying areas near Lake Rotorua bog develops, favouring the growth of deep sphagnum (bog-moss) beds. Sphagnum is a product noted for its antiseptic, absorbent, and deodorizing properties. In a dried state it is used for various medical purposes, such as dressing wounds. Moist it is utilized for germinating seeds and packing plants. It is also useful in connection with the winter storage of carrots, artichokes, beets, &c. It makes excellent resilient mattresses. Sphagnum is air-dried in considerable quantities by the local Maoris.—*B.C.A.*

IMPORTATION OF FERTILIZERS IN 1928–29.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1929, are now (by the courtesy of the Comptroller of Customs) available for study, and, with other data, have been compiled for the *Journal* in the accompanying tables.

The importations of basic slag have constituted a record tonnage, nearly double that of any previous year. It is satisfactory to report that no low-grade slag has been noted among the year's shipments.

Bonedust has now almost disappeared from the returns, only 554 tons having been imported during the year. The Stock Act requires all imported animal-manures to be sterilized, under the supervision of a New Zealand Government officer, before shipment to the Dominion. The very small importations from Australia of late years have necessitated the discontinuance of inspection in the Commonwealth, and bonedust is at present imported only from India.

The importations of Nauru and other island phosphates show a steady increase. For the manufacture of superphosphate, phosphate rock has also been received from Morocco during the past two years. The output of superphosphate from the various New Zealand works for the year ended 31st March, 1928, was 275,288 tons, valued at well over a million pounds sterling. The records for the year under review are not yet available, but the indications are that these figures will be exceeded considerably.

A type of phosphate which has hitherto not been imported in any quantity is that recorded in Table 2 as "North African phosphate (other)," and in Table 3 under the heading of phosphate from Belgium. This is a phosphate rock from Tunis containing 28–30 per cent. phosphoric acid. The raw material is exported to Europe, where it is very finely ground, and re-exported. It is offered on the New Zealand market under various proprietary names. By the official citric-acid solubility test this product has a solubility of about 40 per cent. of the total phosphate, as against 80–90 per cent. in basic slag, and 8–10 per cent. in the average ground rock phosphate.

Other fertilizers new to the Dominion, and at present only imported in small quantities, are the German concentrated fertilizers Nitrophoska and Diammonphos (diammonium phosphate), and urea. Nitrophoska is one of the so-called "complete" fertilizers—that is, fertilizers containing the three ingredients nitrogen, phosphoric acid, and potash. It is prepared by melting ammonium nitrate and adding to it potassium chloride and diammonium phosphate. The pulpy mass is well mixed while cooling, and is marketed in a granular condition. This is a highly concentrated preparation which may find useful application in intensive cultivation (market-gardening, &c.). Being soluble in water, it may be used as a liquid manure. Owing to the relatively high proportion of nitrogen and potash in Nitrophoska, it will no doubt best be employed in association with phosphatic fertilizers or on land that is already well supplied with phosphate. Diammonium phosphate is marketed as a finely crystalline preparation containing high percentages of nitrogen and phosphoric acid. Like

Nitrophoska it is offered in various grades, with different ratios of fertilizer ingredients. Urea is a nitrogenous fertilizer containing 46 per cent. of amide (organic) nitrogen. Its relative efficacy in comparison with such fertilizers as nitrate of soda and sulphate of ammonia has not yet been fully determined. These highly concentrated fertilizers should be applied with caution until the amounts of the most useful dressings are ascertained. Too heavy applications may easily cause damage to or loss of the crop.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1928–1929 AND 1927–1928.

Fertilizer.	Quantity.		Declared Value.	
	Year 1928–29.	Year 1927–28.	Year 1928–29.	Year 1927–28.
	Tons.	Tons.	£	£
Bonedust	554	725	4,751	6,229
Bone-char	..	201	..	662
Basic slag	93,222	48,913	235,285	133,400
Superphosphate	1,037	6,616	2,587	18,304
Nauru and Ocean Islands phosphate	134,323	129,084	175,487	170,349
Island phosphate (other)* ..	43,734	33,199	66,816	50,346
Egyptian phosphate	6,000	6,603	18,975	19,974
Morocco phosphate	14,421	13,389	22,006	19,023
North African phosphate (other) ..	12,499	..	29,856	..
Phosphate (other)	..	38	..	219
Guano (nitrogenous)	..	35	..	413
Kainit	880	786	2,860	2,164
Muriate of potash	36	23	397	198
Sulphate of potash	1,727	1,502	17,854	14,809
Potash salts (other)	10,786	4,267	50,288	18,913
Sulphate of ammonia	2,268	1,077	28,053	16,239
Nitrate of Soda	1,780	1,021	18,968	11,699
Cyanamide	4	..	30	..
Sulphate of iron	72	131	510	1,332
Fertilizers unspecified	802	84	5,687	1,344
	324,145	247,694	680,410	485,617

* For details see Table 3.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1919–29.

Year ended 31st March,	Bonedust.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1919 ..	3,468	..	21,400	31,351	..	..	..
1920 ..	6,272	2,759	15,842	38,861	15,000	..	..
1921 ..	4,440	10,823	40,731	70,208	10,810	..	..
1922 ..	4,063	13,488	3,140	45,956	..	..	..
1923 ..	2,446	19,641	..	69,591	..	..	..
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	14,421	12,499

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1928–29, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.	Chile.	India.	Morocco.	Egypt	Pacific and Indian Oceans Islands.		United Kingdom.		Belgium.		France.		Germany.		United States of America
	Sulphate of Ammonia.	Nitrate of Soda.	Bonedust.	Phosphate.	Phosphate.	Name of Island.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Basic Slag.	Phosphate (other).	Basic Slag.	Potash.	Basic Slag.	Potash.	Sulphate of Ammonia.
Auckland ..	399	1,710	475	17,733	1,750	Nauru ..	72,300	521	4,600	39,924	11,726	923	3,803	6,820	1,905	400
						Makatea ..	12,555									
						New Caledonia	2,082									
						Seychelles ..	4,072									
New Plymouth	40	..	..	..	..	Nauru ..	11,201	10	4,506	17,217	143	100	443	1,691	480	..
						Walpole ..	360									
						Makatea ..	2,658									
Wanganui ..	60	..	..	..	..	Nauru ..	16,711	..	..	..	..	..	..	..	..	..
						Seychelles ..	711									
						Makatea ..	2,564									
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	69	..
Wellington ..	43	..	..	1	3,250	..	..	189	2,168	6,533	495	80	421	2,950	567	151
Nelson ..	3	..	..	..	..	New Caledonia ..	383	77	25	35	..	..	100	695	78	..
Blenheim ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	26	..
Lyttelton ..	180	..	25	4,439	1,000	Nauru ..	22,909	..	..	65	..	..	295	..	282	10
						Makatea ..	2,643									
						Juan de Nova	1,701									
Timaru ..	..	..	..	..	..	Walpole ..	317	..	..	25	..	..	..	..	100	..
						New Caledonia	760									
Dunedin ..	30	..	25	..	..	Nauru ..	10,008	..	100	490	100	..	285	..	530	62
						New Caledonia	380									
						Juan de Nova	1,653									
Invercargill ..	36	..	..	..	..	Seychelles ..	8,676	..	50	3,160	55	..	1,990	1,165	953	..
						Walpole ..	2,219									
						Nauru ..	974									

FLOORING-MATERIALS FOR DAIRY FACTORIES.

F. H. McDOWALL, D.Sc., Dairy Research Institute, Palmerston North, in the *New Zealand Journal of Science and Technology.*

THE material used for the floors in New Zealand dairy factories has hitherto for the most part been Portland cement, mixed either with sand and metal as a concrete which is tamped to a fine surface, or as a concrete which is surfaced with a second layer of sand and cement. While floors of this material have given a considerable measure of satisfaction, it cannot be said that they are ideal for the purpose. They are not sufficiently resistant to wear, especially where milk-cans are being moved over them; they are liable to crack; and, more particularly, they are not resistant to the corrosive action of milk and its products. In a large number of cheese-factories in New Zealand recently visited by the author the surface smoothing of the floors had been etched away in many places, leaving a rougher surface, with the stones of the original concrete showing as nodules on the surface.

During a recent tour of Europe and the United States of America the opportunity was taken of making inquiries in an endeavour to find a more satisfactory material for dairy floors. As a net result of these inquiries it may be stated that there is at present no cement available suitable for dairy-floors which will resist completely the corrosive action of milk. In all the countries visited on the Continent of Europe the difficulty is met by the use of tiles laid in a bed of concrete. The joins are filled in with liquid cement, and are grouted every year with the same mixture, as is the custom with tiled whey-tanks in New Zealand. In England the floors in a number of dairies were made of granite chips set in a mixture of ordinary cement. Others were tiled, while the ordinary concrete floor was not uncommon. In America, in cheese and butter factories, the floor was usually of concrete, though tiled floors were observed in a number of places.

The use of steel sheets, or steel networks, for strengthening the surface of the receiving-platform was observed in every country visited. In Holland a special steel "tile" has recently been introduced to take the place of such steel sheets, which have the disadvantage that they become smooth and slippery. The tiles are 8 in. square, and the surface is specially grooved to prevent slipping. A sample of these tiles is available for inspection in the Chemistry Laboratory at the Dairy Research Institute in Palmerston North. The tiles are set in a foundation of concrete. The cost in Holland for such tiles is 15s. per square yard, exclusive of the cost of the concrete foundation and the cost of setting.

The following specifications are supplied for the setting of the tiles: The foundation on which they are laid must be free from vibration, which would gradually dislodge the plate. The floor should be perfectly cleaned from dust. It should then be wiped with a thin liquid cement, which should be allowed to dry a little. A layer 1 in. in thickness of mortar (1 sand, 1 cement) is then applied. The iron tiles should be cleaned dust-free and brushed over with thin liquid cement. They are then filled carefully with mortar so that no air-bubbles are included.

They should then be wiped with a straight-edge so that they are completely full. They are turned over and pushed—without being knocked—into position, as the vibration breaks the contact between the tiles and cement. It is essential to use a fairly wet mortar. When the floor has been laid, a thin layer of cement is placed all over the top to ensure that all the cracks have been filled. This wears off in a short time.

The use of bitumen and asphalt for dairy-floors is restricted by their tendency to soften on heating, and by their solubility in fats. Apart from these disadvantages their acid-resisting properties would render them ideal materials.

Within recent years a special bitumen flooring has been patented, and is now being manufactured in Birmingham under the name of "Prodorite." A specially prepared high-temperature bitumen is used, mixed with fine metal and other materials. The mixture is cast into 12 in. slabs, either plain-surfaced or with a diamond grooving. The slabs are set into a layer of "Prodorite compound" joining-material on a concrete foundation. Since the process is carried out with the compound at a very high temperature, a perfect weld takes place. The resulting floor has an exceedingly hard wearing-surface, and is quite impermeable to water and acid. The compound also makes the necessary provision for expansion and contraction, so that any chance of cracking is eliminated. The floor is ready immediately after laying, as the Prodorite compound hardens completely on cooling.

There seems to be no possible doubt that the flooring will be immune from the corrosive action of acids. The same material is used in the form of tanks for storage of 30 per cent. hydrochloric acid, and the author has seen such a tank in perfect condition after three years' continuous use. It softens on heating, but less easily than the usual bitumen floorings. The makers do not recommend it for temperatures above 160° Fahrenheit. Its resistance to abrasion, on official tests, is twice as great as that of ordinary 2 : 1 sand and cement; and it has the remarkable crushing-strength of 6,000 lb. to the square inch. Its slight solubility in fat may restrict its usefulness for dairy-floors. This matter is now under test at the dairy factory at Massey College, where a portion of the floor of the butter-room has been laid down in Prodorite.

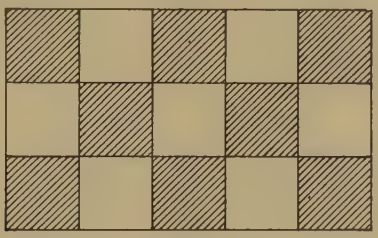
An aluminous cement under the name of "Ciment Fondu" has been extensively used during the last few years in England and on the Continent of Europe for constructional purposes. It possesses the property of setting almost to its final state of hardness within twenty-four hours after being mixed. Measurements have shown that a 4 : 2 : 1 concrete gives a compressive strength of 8,000 lb. per square inch twenty-four hours after gauging. This is a valuable characteristic for dairy-floorings, especially in factories which are in operation throughout the whole year. For emergency purposes in replacing the foundations of separators and other dairy equipment it is particularly useful.

The manufacturers claim that Ciment Fondu is much more resistant than Portland cement to the corrosive action of weak organic acids such as lactic acid, although the claim is not made that it is *acid-proof*. No information was available from dairy factories where the material had been tested under practical conditions for dairy-floors, but the writer is in correspondence with the technical adviser to a large English dairy

company in one of whose factories a trial flooring of this material has been laid down. It is hoped that reports will be received from time to time of the conditions of the floor.

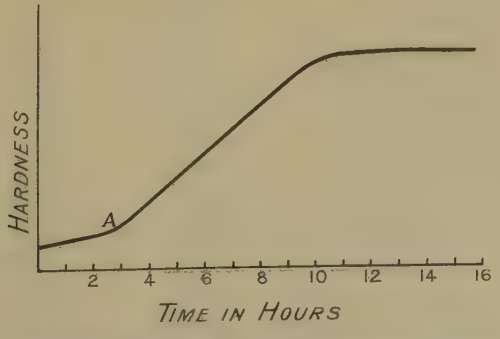
A small area of the flooring has been laid down in the factory at Massey College, but the results of the test may be somewhat doubtful, since the cement appeared to have deteriorated to some extent in transit, and since the workmen had not had sufficient opportunity of gaining experience in the special methods of treatment which it requires.

The most troublesome factor in the use of concrete as a flooring-material is probably the contraction which takes place on setting, resulting often in irregular cracks, disfiguring the surface. To obviate such cracks, floors are often laid down in sections. Ciment Fondu has the same coefficient of contraction as Portland cement, but because of its rapid-hardening properties it can very conveniently be laid down in sections, preferably about 10 ft. square. Alternate sections are laid the



first day, as shown in the diagram. By the following day these are quite hard and fully contracted, and can be used as the working-area for preparing the mixture for the remaining part of the floor. The concrete is filled directly against the edge of the day-old sections. The contraction spaces are thus reduced to a much smaller width than is possible with Portland cement.

The setting-point occurs two to three and a half hours after mixing, the actual time depending on the temperature. It is indicated by a change in the sheen of the surface. The final smoothing of the surface must be carried out at this point (A in the graph), within ten to fifteen minutes, as the change in hardness at the setting-point is extremely rapid.



The concrete should be flooded with water as soon as this can be put on without damaging the surface, in order to reduce contraction, and it should be kept damp with wet sacks for twenty-four hours.

It is even more essential than for Portland cement that the sand used with Ciment Fondu should be perfectly clean.

The cost of Ciment Fondu in England is £7 per ton for 10-ton orders. For export to New Zealand special containers are necessary, which add somewhat to the f.o.b. price. It is possible that there may be some difficulty in importation owing to the tendency of Ciment Fondu, as of Portland cement, to deteriorate slowly with time. This can be tested out only with small trial shipments.

SUMMARY.

There appears to be no true cement at present available suitable for dairy-floors which will resist the corrosive action of milk and whey. The ordinary bituminous floorings are too soft and too soluble in butter-fat. The new bituminous flooring, Prodorite, has a very satisfactory wearing quality, is quite unaffected by the acids of milk, and is more stable both to the softening action of heat and the solvent action of fat. Although it is not completely fat-resistant, it may possibly prove a very useful material for dairy-floors.

Ciment Fondu is a quick-setting aluminous cement which yields a surface available for use twenty-four hours after mixing. It is very suitable for the laying of dairy-floors in sections. The claim is made by the manufacturers that it is more resistant to the action of acids than Portland cement. Some knowledge is still required of its ability to withstand export conditions without any deterioration in quality.

The author will gladly furnish further particulars to any one interested in trying out the floorings herein described.

OFFICIAL GRADING OF NEW ZEALAND EXPORT CHEESE IN WHARF SHED AT AUCKLAND.

[Photo by H. Drake.

SEASONAL NOTES.

THE FARM.

PASTURE MANAGEMENT.

ALL dairying pastures will benefit from thorough chain and tripod harrowing during the winter. Especially so is this the case with pastures on which winter supplementary feeding has been carried out. The organic matter of spread droppings from stock has a wonderfully stimulating effect on both clovers and grasses, and frequent chain and tripod harrowing is necessary for the maintenance of a good even turf. In harrowing old pastures it is not sufficient to spread the droppings only, but the harrows should be heavy enough to slightly tear the surface and allow the aeration of the surface layer of the soil.

The efficiency of nitrogenous fertilizers in promoting an early spring growth of grass was discussed briefly in last month's notes, and farmers with early-calving herds should experiment on a small scale with these fertilizers. It should be remembered that the application of nitrogenous fertilizers to grassland is still in the experimental stage in this country, and that it has not yet been fully determined whether their use is payable. In order to measure the effect of nitrogenous manures in stimulating early spring growth it is necessary to shut up two fields at the same time—one dressed with nitrogen, and the other without the nitrogenous dressing. The turf on these trial fields should be similar, and it should be remembered that nitrogenous fertilizers are most efficient in providing early spring feed on pastures which are composed mainly of perennial rye-grass. Sulphate of ammonia at the rate of 1 cwt. to 1½ cwt. per acre, applied in July, is a suitable dressing, and the fertilizer should be put on just before rain. The trial pastures should be fed off with milking-cows when 3 in. to 4 in. high, and care taken not to graze the pastures too hard during the early spring, when the recovery of grass-growth after grazing is normally slow.

Owing to an inadvertent transposition an error occurred in last month's notes in the reference to autumn and early winter production of grass (third paragraph of page 347), whereby July was included in the growing-period. The sentence should read: "On rye-grass pastures the autumn and early winter growing-period extends to the end of June, while July, August, and early September are months of normally poor growth of rye-grass."

SPRING SOWING OF OATS, WHEAT, AND BARLEY.

Spring-sown oats and wheat are usually sown in August and early September, and barley in September or very early October, so as to avoid the crop being flooded in the early spring. The

nature of the preparatory cultivation for these crops will depend on the class of land and the position they take in a given field rotation.

Land after swedes or soft turnips is usually not clear till the end of July or middle of August, so that the seed-bed for spring cereals after roots must be prepared quickly. Cultivation work should be pushed ahead during all good weather, and the oat crop is usually drilled before a start is made on the preparation of the seed-bed for the barley crop. On light land the roller can be used with advantage in consolidating the seed-bed, but on heavy land its use should be avoided, as it causes the soil to settle down and cake. Spring-sown cereals benefit from a rolling after drilling, but unless the land is light the rolling should be delayed till September or early October, when the land is generally drier. Rolling hardens the surface, breaks the clods, and lessens the amount of dust at harvest-time. In places of low rainfall cereal crops should not be rolled until the crop is 8 in. to 10 in. high, so that moisture will not be lost by evaporation from the bare rolled surface.

Oats do better after grass than any other cereal. On light land the ground should be ploughed in July, rolled on the furrow, disked to a fine seed-bed, and harrowed and rolled before drilling. On heavy land the ploughing can often be best done with the digger plough with a skim coulter and knives attached to the tail-plates, which leaves the land in a fit condition for disking.

Spring cereals often follow a winter fallow, and are usually taken in this place when the land was prepared for autumn and winter cereals and the weather prevented sowing at that time. Barley often does best when taken in this position in the rotation. If the land has settled down badly in the winter, it should be ploughed and worked again before the crop is drilled.

Cereals sown in the spring require a heavier seeding than when sown in the autumn, because less tillering takes place than is the case with autumn-sown crops. Also, with cereals for threshing a light seeding in the spring will give rise to a number of late tillers, and consequently a high proportion of shrivelled grain. The average seeding for spring cereals will be about 2½ bushels to the acre, but the amount will vary from 2 to 3 bushels, depending on the cereal and the local conditions of soil and climate.

All spring-grown cereals should be manured with phosphates. A dressing of 1 cwt. superphosphate in the subhumid, arable farming districts, rising to 2 cwt. to 2½ cwt. in the humid districts, will always give payable increases in yield.

WINTER FEEDING OF LIVE-STOCK.

In feeding dry dairy cows in the winter it should be remembered that normally a cow's fodder consists of green pasture grass with a moisture content of about 70 per cent. Pasture hay contains only some 15 per cent. of water, while roots contain about 90 per cent. If cows in the winter are fed either hay alone or roots alone, digestive troubles are bound to occur. The ration of a cow should be balanced so that it contains both dry and watery foods, the

normal ration being about 14 lb. of hay and 50 lb. to 60 lb. of mangolds. Cows, when dry, are satisfied with bulky foods having a wide nutritive ratio, whereas when in milk they require highly nutritious fodders with a narrow nutritive ratio. Economy of feed is obtained by wintering the cows on coarse fodders such as hay and roots, and saving as much as possible of the winter growth of grass for the spring when the cows calve. When feeding hay and roots the hay should be placed in the field first thing in the morning, and the animals should be allowed to eat part of their hay ration before the roots are thrown out for them. Eating half-frozen roots on an empty stomach is a frequent cause of digestive troubles.

Breeding-ewes on fat-lamb-raising farms should receive careful attention during July to ensure that they get sufficient exercise to keep them in a healthy condition. Ewes on turnips should be moved off at night to a bare grass-paddock, and not put back on the crop until the frost is off the ground. Care should be taken that the ewes are not unduly hurried or crowded when moving from one field to another.

—P. W. Smallfield, M.Agr.Sc., Fields Superintendent, Auckland.

THE ORCHARD.

PRUNING OF PIP-FRUITS.

THE practice of pruning as applied to fruit-trees has for its main objects the formation of vigorous, healthy, and mechanically strong trees, shaped in a certain fashion for convenience and economy in orchard-management, to effect a distribution of the fruiting-area over the whole tree, to regulate the size of fruit and improve its quality, and to regulate the crop. It may be assumed that by the practice of thinning out, and the shortening-in of leading shoots, a satisfactorily strong tree has been produced and good growth maintained. When the time arrives for the strong-growing non-bearing tree to produce fruit the treatment then and subsequently must necessarily be carried out with judgment, and must be modified according to the general vigour and of the variety.

Fruitgrowers will readily call to mind orchards and individual trees displaying varying degrees of vegetative vigour and fruitfulness. Attempts have often been made to influence wood-growth and the productiveness of the tree by pruning alone, but the fact that pruning is only one of the factors which modify plant-growth and productiveness has been overlooked. Cultivation and application of fertilizers are factors which must be considered along with pruning in endeavouring to regulate the growth and fruitfulness of an orchard. It should be the aim of the orchardist to maintain his trees in a state of moderate growth with fruitfulness. Very heavy cutting generally results in rank vegetative growth, and in bearing trees a reduction in fruitfulness. Heavy fertilization in addition to this treatment, providing there is sufficient soil moisture, would produce growth still ranker and little or no fruit. This may

be a useful expedient in ultimately bringing into profitable production trees which have suffered through overcropping, disease, &c. No pruning and lack of plant-food tend towards over-production, and if such treatment is continued a condition is soon reached where there would be neither wood nor fruit produced. Bearing in mind the foregoing facts, a pruner should be able to judge in a general way the particular treatment required in dealing with a whole orchard or any portion of it, or with the individual tree.

The lighter the pruning of young trees, consistent with the securing of proper framework, the greater will be their development, and the sooner will profitable crops be produced. The more severely young trees are pruned the longer they remain unfruitful. A period of unfruitfulness must, however, be endured in the building-up of the proper framework. On older trees where bearing is fully established heavier pruning will often be necessary in order to continue regular bearing and to maintain the necessary growth. Supplementary fertilization may be necessary also.

In the promotion of fruitfulness pruning is of value in distributing fruiting-wood uniformly throughout the tree. For fruit-bud formation light is required, and pruning is practically the only means of securing a favourable distribution of light. Regular pruning brings about the best result, as it is only by annual cutting that a constant renewal of fruiting-wood may be secured. Size of fruit is largely influenced by the amount of wood-growth. A tree making satisfactory wood-growth usually produces a crop of larger sizes than those which are unsatisfactory in this respect. Thus system in pruning may provide the means of producing fruit of a size suitable to a particular market.

The principles just outlined apply to both apples and pears. For the correct application of these principles, a brief study of one or two individual varieties may be a help.

Delicious.—This is naturally a strong-growing tree in its earlier stages, and fruitfulness would be delayed by a continuation of severe cutting. Once the foundation of the tree and framework has been secured, a thinning-out and little shortening-in of suitably placed stronger growths may be resorted to—in fact, such growths might be left unpruned. An extension from the terminal bud takes place with a good development of fruit-spurs. On exceptionally strong-growing trees a further extension might be allowed the following year. Cutting back into two- or even three-year-old wood —preferably to a strong shoot—must then be resorted to, otherwise wood-growth may become too weakened. A study of each shoot must determine the subsequent treatment.

Jonathan.—The Jonathan represents a weaker type of tree of early fruiting habit, and every effort should be made to maintain vigour and growth, as its best fruits are borne on two-year-old wood. Leaders should be shortened-in fairly severely and encouraged to grow erect. Laterals retained for fruiting should not be cut back to stubs, but given two-thirds to three-quarters of their length. A lateral cut back slightly would extend from its terminal bud and produce one or two shoots near the terminal, and also develop a

number of fruit-buds which should carry fruit the following year. In the second pruning the lateral could be cut back to a strong shoot, which would have part of its length removed, forcing a growth from the last bud and the development of fruit-buds along its whole length during the next growing-season. The lateral would thus extend, but in a very few years would become very weak unless the treatment was varied. Fruit would become small, buds would weaken, and possibly mildew make headway. A drastic shortening-in of laterals and fruiting-arms to force growth would be required. A certain amount of such hard cutting should be done every year to promote new growth and renew the old fruiting-wood.

Sturmer.—Many varieties of apples tend to overbear, and much hand-thinning is required. Thinning the shoots and branches, and also thinning the spurs, renewing the much-branched ones by removing the older parts and saving the newer, will tend to invigorate the tree and reduce the crop somewhat. This will encourage annual bearing and reduce the amount of hand-thinning necessary. Such treatment is often found necessary on a free-spurring variety such as Sturmer.

—N. J. Adamson, Orchard Instructor, Hastings.

Citrus-culture.

Poorman oranges are a crop which to harvest to best advantage requires several pickings. No fruits should be picked unless the green colour has changed to a shade of yellow, otherwise a pronounced wilting will take place if their disposal is delayed even for a short period. The fruits should be very carefully handled, as skin-punctures or stem-ruptures rapidly lead to moulds and decay. Where it is intended that they be shipped long distances fruits should be allowed to remain a few days in open cases for preliminary evaporation. Fruits close-packed direct from the tree are prone to sweat, and under very bad conditions may discolour and decay set in. When fruits are intended for preserving they should be picked as soon as size and colour are attained. When the larger sizes are intended for sale as grape-fruits they can with advantage be allowed to hang longer, as quality is more readily attained on the tree than in storage.

Lemons should be picked as they attain correct size and change of colour, and then put away for curing and storage. Stored lemons should be checked over frequently at this season, as decays are more prevalent than with fruits picked in dryer seasons.

Where the recommended precautions have been taken to safeguard against brown-rot, little infection should be expected, but it will be as well to apply bordeaux, 4–4–40, during a spell of fine weather. Should brown-rot be present every care should be taken to collect and destroy diseased fruits.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

PREPARING FOR NEXT YEAR'S WINTER LAYERS.

It is now recognized as an established fact that if poultry-keeping is to prove a really profitable undertaking eggs must be produced in good numbers in other than the spring and summer months. The fact that fresh eggs during recent months have commanded more than double the price of those produced during the flush season of supply goes to indicate how many producers there are out of the 154,000 poultry-keepers in the Dominion who fail to secure eggs when high prices rule. Obviously there can be no comparison made as regards profit between a bird laying the bulk of her eggs during the dear season and one producing her main yield in the cheap season, when almost any sort of fowl will lay. The poultry-keeper who secures a good supply of eggs when prices are high is usually termed lucky by those who fail. There is no luck about it, for it is nothing other than the result of common-sense management combined with strict attention to details. Those poultry-keepers who have failed to secure high-priced eggs in the past, and who desire to secure them during the next dear season, must prepare the way for them now. Pullets must be depended upon, and the early pullet must be hatched out at a time other than the natural breeding-season for bird-life; further, it must be well fed and managed throughout all stages of its development. The breeding-birds should be mated at once, if not already done, in order that fertile eggs may be available for hatching purposes by the beginning of July. If the earliest pullets are hatched during July these will commence to lay when the majority of the adult stock are terminating their laying season, and at a time when egg-prices commence to rise.

It may be said, and rightly so, that the bulk of the July-hatched pullets will moult in the late autumn, and that there will be a loss of winter eggs. This is quite possible, but on well-managed plants there should be later-hatched pullets specially bred for laying during the cold months of the year. In any case all the early-hatched birds will not moult and cease to lay at exactly the same time. Obviously some birds will moult earlier than others, so that when the latter are moulting the former will have renewed their feathers and be ready to resume laying. Another advantage in having such stock on the plant is that owing to their moulting during the late autumn or early winter they can usually be depended upon to lay well into the autumn or early winter during the following year, when the price of eggs is on the up grade.

The writer quite realizes that on the average plant adult birds are seldom laying at this period of the year, and that in order to secure early chicks the poultry-keeper is of necessity forced to use pullet eggs for incubation. Here it may be mentioned that the principle of breeding from pullets for the maintenance of a heavy-laying flock—in other words, as a foundation stock—is not recommended; but in the case of breeding, especially for the production

of autumn eggs, an exception must be made. In any case, the pullets bred for this purpose need not necessarily be used for future breeding purposes. Experience goes to show that if pullets are well developed, have been bred from an adult hen, and commenced to lay early in the year without being forced, most desirable progeny may be produced by mating them with a second-year male. The great danger lies in using in the breeding-pens pullets which have been bred from pullets generation after generation, as such usually results in the production of weak-constitutioned stock and layers of undersized eggs. Especially is this the case when the pullets have been mated with cockerels bred in the same way.

These remarks refer only to early hatching for the production of pullets for autumn and early winter laying; August and September are equally favoured as being the best months for hatching out the main flock of layers.

BREEDING-POINTS.

In choosing birds for the breeding-pen, whether pullets or hen, one should aim for birds of uniform laying type, combined with points indicating good health and constitutional vigour. The latter quality is usually indicated by a prominent, fiery eye, bright-red comb and face, close and thick feathering, short shanks set well apart, well-developed crop, and a general active and business-like appearance. The chief points indicating egg-capacity are an oblong body, width across the back, depth and fullness of abdomen, together with fine texture throughout.

In the mating of stock the male bird has an important bearing; he is more than half the stock. He should, above all things, possess the signs indicating strong constitutional vigour as referred to in the selection of females. Further, he should be the son of a healthy mother with a record of egg-laying performance behind her. He should also possess strong masculine characteristics, as indicated by good chest-development, good width and depth of body, stout legs, with flat bone (not round), a stout well-curved beak, and generally a bold carriage. It should always be remembered that the feminine-looking male or the masculine females should never be bred from.

With regard to size, whether in male or female, one should never breed from diminutive specimens of their breed. The small ones will come soon enough even when good-bodied birds are mated. If a desirable size is to be maintained, all breeding stock should conform to the weight clauses as contained in the Utility-poultry Standards for the respective breeds. Copies of this publication are obtainable from the Department of Agriculture at a cost of 3s. each, postage free.

The number of hens to mate with one male depends entirely on the local conditions affecting the stock and plant. Where a good range is provided a high proportion of fertile eggs may be obtained by using one male to twenty or more females; but when the birds are confined in a house or run the number must be considerably reduced if good results are to be secured. No hard-and-fast-rule, however, can be laid down in this respect. The

poultry-keeper must use his own discretion, and be guided by the number of fertile eggs produced. In a general way, when the birds are confined, and during the early season, six to eight hens of the heavier type will usually prove sufficient for one male. If the male is a vigorous one this number may be increased as the season advances. With the lighter breeds, such as Leghorns and Minorcas, eight females may be mated to one male, and in the spring months up to twelve or even fifteen.

For the management of the breeding-pen readers cannot do better than follow the advice published in these notes in the last April issue of the *Journal*.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

THE WINTER SEASON.

DURING the ensuing months there will be little to do in actual bee work. Manipulation of the colonies must cease on account of the cold weather, and other work of this nature must be set aside until the spring. The chief thing is to see that none of the colonies starve, as losses of this kind, when made in the winter, spring, or early summer, detract considerably from the following honey crop. To secure an increase in colonies without material loss in strength in the individual hives requires a considerable amount of time and labour, and should a bad spring be experienced expense will also be incurred. It pays, therefore, to look well after colonies already formed, and from 30 lb. to 40 lb. of sealed stores should have been left at the disposal of each colony at the commencement of winter, thus assuring strength in the spring. Do not at any time disturb the cluster of bees.

Should it be found necessary to give additional feed, this should be placed alongside the bees inside the hive. A comb of clean sealed honey or a cake of candy is best. Do not feed honey from a doubtful source, as it may contain the spores of foul-brood. Some beekeepers prefer to feed sugar-syrup in the spring, and so stimulate the bees to start brood-rearing earlier than they otherwise would do. This is sometimes advantageous and even necessary, but at the same time a colony will require less attention and do equally well if left with plenty of winter stores.

It is a good plan to remove damp mats from the top of the frames and replace with dry ones. Damp mats also indicate that the cover or roof requires repairing, and this should be attended to.

Spare supers that were left on the hives should now be removed, where it can be done without unduly disturbing the cluster, and the bees confined to the brood-chamber. In the northern parts of the Dominion breeding will start in colonies of normal strength at the latter end of July, and every effort should

be made to make the bees snug, so as to promote breeding. Where the bees have taken to the supers entirely the bottom story is the one to be removed.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies are by this means reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrances should be contracted.

A periodical examination should be made of all extracting-combs stored in the honey-house, for the purpose of seeing that they are not attacked by moths. Where the combs have been attacked they should be fumigated. For this purpose place the combs in supers piled one above the other, and put a saucer-full of carbon bisulphide on the top. The fumes, being heavier than air, will sink slowly to the bottom, destroying all moths and eggs with which they come in contact. Care should be taken not to inhale any of the fumes, as they are poisonous. The gas being highly inflammable, it should not be brought into contact with a naked light.

PERMANENT SHELTER.

This is the season when it is most evident to the observant apiarist that bees require plenty of shelter from high winds. Where necessary, the planting of shelter-hedges to protect the apiary should now be taken in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected, the bees can take exercise every sunny day during the winter months, and this exercise is essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided, numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the apiarist will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of about 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges, giant privet and tagasaste ("tree lucerne") are perhaps the best. These plants have been tested throughout the Dominion with good results. In the South yellow barberry holds pride of place as a hedge for apiaries, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever species are used, planting should be done with the idea of forming a thick hedge, and not to form a plantation. If tagasaste or giant privet are planted they should be well protected from stock.

LIQUEFYING GRANULATED HONEY.

Many of the public still have doubts regarding the purity of honey when it is granulated—that is, when it is in the solid crystallized form. Consumers have speculated on the point, some declaring that sugar had been mixed with the honey to bring it to

that form. Such, however, is not the case, as practically all honeys throughout the Dominion granulate, and it is usually found that when foreign matter is introduced the granulation process is greatly retarded or stopped altogether. Thus, if honey is in a granulated form, this condition may be regarded by the layman as one of the best indications of its purity.

It is frequently desired that honey be consumed in liquid form, and in this case the glass jar or tin containing the granulated article should be placed in a vessel of water at a temperature of about 140° F. This heat should not be exceeded, as otherwise the aroma and flavour may be seriously affected or destroyed. Sometimes, according to the solidity of the granulation, the honey may take as long as three hours to properly liquefy. It is advisable to place something under the tin or jar to keep it from direct contact with the bottom of the heating-vessel.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

STARTING THE NEW TOBACCO CROP.

In most tobacco-growing districts it is now becoming customary to sow the seed towards the end of July in pans or boxes, and to raise the plants in a glasshouse. They are then ready for pricking out into seedling beds about the end of August or the beginning of September. For this purpose it is important to obtain seeds of a suitable variety and high strain. Some experimenting has been done in many localities, and growers will now have a better idea of the variety suited to their soil and purpose, but the seeds should be obtained from a specialist who has a reputation for that work, so that the type may be uniform and of a high standard. Annual plants of this class very quickly deteriorate in type unless the greatest care and skill is exercised in growing the seed.

Good well-rotted turf is suitable for the seed-boxes, and it will be all the better if it is sterilized. It may be put through a ¼ in. sieve, and a layer of the more fibrous material placed on the bottom. The boxes should then be filled within an inch or so of the top with fine soil, and pressed down firmly with a piece of board. If necessary, water the soil by immersing the box in slightly tepid water, and, after draining well, sow the seed thinly and press it into the soil. A long 0·22 empty cartridge-case, when filled, contains about 2,000 seeds, sufficient for the ordinary seed-box measuring 18 in. by 12 in. It should produce 1,500 seedlings, and four or five of these seed-boxes should be grown to plant an acre in the field. A sheet of glass placed over each box will prevent the soil drying out and assist germination. Dry the glass by turning it over daily, and remove it as soon as the seeds germinate. The temperature may go up to 80° F. during the day with the ventilators open, but it should not fall below 45° at night with the house closed up.

Stored leaf in bulk should be examined occasionally to see that all is well. If large bulks are built in good well-ceiled rooms, on

good floors well up off the ground, there is not likely to be any unsatisfactory development; but if the leaf is exposed to changes of temperature and a humid atmosphere great care is needed. Small quantities are best held in a good packing-case.

TOMATOES AND SMALL FRUITS.

Seedling tomato-plants under glass will now be ready for pricking-out, and this should be done with care to avoid chilling them. Once the plants are established, however, they should be grown hardily, and given air in bright warm weather. The danger from frost is considerable in some localities, and in extreme cases one or two heaters should be available in case exceptional need should arise. One or two growers have electric current laid on, which enables them to plug in a few heaters when needed. This is quite effective, but is hardly warranted where supplies of stable manure are available for a good hotbed.

The pruning of bush fruits should now be completed, and the bushes should be given such spray treatment as may be necessary. In any case a bordeaux spray at winter strength should be applied just before growth commences, owing to the prevalence of leaf-spot, rust, and other fungi. In the case of the raspberry crop, arsenate of lead may be included with the bordeaux to prevent the attack of insects in the buds. Where scale insects are troublesome, an oil spray at 1–12 or 1–15 will be effectual. For strawberries an application of bordeaux, 4–4–40, or lime-sulphur, 1–80, is usually indispensible to preserve the plants from the attack of the leaf-spot fungus. The foliage should be well covered, and the application repeated as necessary, so that the plants are protected up to the time the fruit commences to set.

Too often the bush-fruit section is expected to yield a good crop with very little spraying and less manure, but the quantity and quality of the berries will be low unless the bushes receive liberal treatment in the way of manuring. Most crops of this class will be greatly benefited if they are now given a dressing of suitable fertilizers. What that should be depends on past practice and experience, but in their absence the following may be applied: 2 oz. superphosphate, 1 oz. sulphate of potash, and 1 oz. sulphate of ammonia per square yard. This should be broadcast and lightly worked in, taking care not to disturb the fibrous roots which lie close to the surface.

THE MARKET GARDEN.

Savoy cabbage, celery, leeks, and roots are now being harvested and placed on the market, with cauliflower, broccoli, and spring cabbage coming to maturity.

Asparagus and rhubarb beds will shortly start into growth, and the busy spring-time operations will commence with plantings of autumn-sown onions, lettuce, cabbage, and cauliflower; also the sowing of lettuce, radish, spinach, onions, and broad beans, as soon as the soil is in condition. New beds of rhubarb may also be made, and in warm districts early potatoes and peas may be planted and sown. The preparation of the land for these and later

crops should now be completed as soon as possible, incorporating a good dressing of well-prepared organic manures for such crops as cabbage, cauliflower, salads, peas, and rhubarb. Complete the preparation of the land by hoeing in fine weather to destroy seedling weeds, and obtain a fine tilth, working in such fertilizers as may be required shortly before sowing.

Seed potatoes should now be stored in a light cool place that is not too dry. They may be spread in trays, or, as is more general, stacked in well-ventilated boxes in a suitable place. Under such conditions the growth will be short and sturdy, and the tubers will not shrivel.

Broccoli and spring cabbage planted in the autumn and now maturing will often be benefited by a small dressing of nitrate of soda or sulphate of ammonia to encourage growth.

Asparagus-beds should now be manured; 2 oz. superphosphate, 2 oz. nitrate of soda, and 1 oz. sulphate of potash, per square yard, will be a useful dressing for those in doubt on the matter. Most crops of rhubarb would derive great benefit from a similar application made now.

THE HOME GARDEN.

Where hard-wooded plants are to be grown, they should be planted now or as soon as possible when the land is sufficiently dry. Fairly large groups are more effective than single plants, and where evergreens are required for a background it should be remembered that our native trees are unexcelled for that purpose in most districts. After planting firmly a little shortening and thinning of the growth is generally advisable, to counterbalance the unavoidable pruning of the roots in transplanting. Hardy herbaceous plants may also be planted, and the comparatively large grouping arrangement is most effective with this class also. Most kinds of herbaceous plants require a rich soil, and a generous quantity of organic manures should be trenched in. In the absence of well-rotted stable manure a liberal dressing of blood-and-bone fertilizer, 4 oz. to the square yard, should be turned well under.

Worn places in lawns may now be patched with turf. As far as possible it should be of similar grasses, and neatly done to leave a smooth surface.

—W. C. Hyde, Horticulturist, Wellington.

Noxious Weeds Orders.—The Pohangina County Council has declared hemlock and burdock to be noxious weeds within that county. The Mangaweka Town District and Hunterville Town District have likewise declared hemlock as regards their respective territories.

Wool Statistics.—The following figures, from a compilation by the New Zealand Wool Committee, refer to the local wool sales for the period from November to the end of March in the two last years respectively: Season 1927–28—Number of bales sold, 514,133; average prize realized per bale, £24 5s.; average price per pound, 16·89d.: total realization, £12,468,097. Season 1928–29—Number of bales, 538,493; average per bale, £21 10s. 11½d.; average per pound, 15·06d.: total, £11,603,428.

LIVE-STOCK PRODUCTION IN NEW ZEALAND.

REVIEW OF PERIOD 1901-2 TO 1926-27, BASED ON STANDARD VALUES AND UNITS.

E. J. FAWCETT, M.A., Farm Economist, and W. N. PATON, Farm Economics Section, Fields Division, Department of Agriculture, in the "New Zealand Official Year-book," 1929.

FOR the purposes of a study of this nature, where the aim is to obtain a general index number or its equivalent depicting combined production, quantities alone are useless, since various commodities are expressed in different units. A combined production figure is arrived at by making use of arbitrary standard values and equivalents. After applying these to the quantities for the various products, values for the latter are obtained. These combined give total production in terms of value. As this aggregate value is derived from flat-rate prices throughout the range of the period studied, they reflect quantity rather than value of production. Index numbers as commonly used have generally a base or par value of 100 or 1,000. In this review it was considered advisable to adopt a unit based on equivalents. This method has the advantage of greater utility, as it may be very simply converted from units to standard value, quantities, or actual values. The unit adopted was one of £10,000, and, as will be seen from the following tabulation, it possesses all the qualities claimed.

STANDARD VALUES USED: GRASSLAND PRODUCTS.

	£	s.	d.
Live animals—			
Cattle (per head)	10	0	0
Horses (per head)	30	0	0
Pigs (per head)	2	0	0
Sheep (per head)	2	0	0
By-products—			
Calf-skins (each)	0	2	6
Hair (cwt.)	5	0	0
Hides (each)	1	0	0
Horns (ton)	15	0	0
Kidneys (cwt.)	2	0	0
Lard (ton)	25	0	0
By-products—*continued.*			
Sausage-casings (cwt.)	20	0	0
Sheep-skins (each)	0	4	9
Tallow (ton)	20	0	0
Meats—			
Calves (each)	0	10	0
Cattle (per carcass)	5	0	0
Lamb (per carcass)	1	0	0
Pigs (per carcass)	2	10	0
Sheep (per carcass)	1	0	0
Wool (lb.)	0	1	0
Butterfat (lb.)	0	1	3

UNIT VALUE OF GRASSLAND PRODUCTS.

(Unit of production = £10,000 at standard values.)

2,000 cattle carcasses	=	1 unit.	5,000 live sheep	=	1 unit.
200,000 lb. wool	=	1 ,,	80,000 calf-skins	=	1 ,,
160,000 lb. butterfat	=	1 ,,	2,000 cwt. hair	=	1 ,,
10,000 lamb carcasses	=	1 ,,	10,000 hides	=	1 ,,
10,000 mutton carcasses	=	1 ,,	666·6 tons horns	=	1 ,,
4,000 pig carcasses	=	1 ,,	5,000 cwt. kidneys	=	1 ,,
20,000 calf carcasses	=	1 ,,	400 tons lard	=	1 ,,
1,000 live cattle	=	1 ,,	500 cwt. sausage-casings	=	1 ,,
333·3 live horses	=	1 ,,	42,106 sheep-skins	=	1 ,,
5,000 live pigs	=	1 ,,	500 tons tallow	=	1 ,,

NOTES.—1. To find total returns for any item at the standard value quoted, add four noughts (0000) to production units given in tables.

2. To find quantity of any commodity produced, multiply the units produced by the number of such commodity which represent a unit.

3. To find sale values for any commodity, add or subtract the difference between prices realized and the standard values used.

The standard values quoted for the various live-stock products are based on what is considered to be approximately an average value over

the period under review. For convenience in calculation, these values in the majority of cases have been taken in whole numbers or simple fractions thereof. In the live-animal section values allowed for animals exported alive are higher than for carcasses, owing to a proportion of the former being pedigree animals. The values for meats have been decided upon after careful thought. The figure for sheep and lamb carcasses gives a decided advantage to the earlier years if interpreted in money, as prices then were low. On the basis of units of production, however, this does not affect the position. Sheep-skins at 4s. 9d. each is an average value for such, with and without wool.

The coefficients given have been derived from the standard values quoted, £10,000 being the value of one unit of production.

Table 1 depicts primary live-stock production on the unit basis. Values for sheep, lambs, pigs, cattle, and calves are based on total slaughterings. The Live-stock Division of the Department of Agriculture compiles and publishes each year figures of slaughterings at abattoirs, meat-export slaughterhouses, bacon-factories, and ordinary slaughterhouses for years ending 31st March. The Census and Statistics Office compiles and publishes slaughterings of stock on farms each year for twelve months ending 31st January. As the latter do not vary greatly from year to year, they have been added to the former to give the total for the season. The figures for total wool-production have been obtained by adding sliped wool to the wool-clip of the season, and are based partly on actual and partly on estimated figures. Wool on skins exported is allowed for under skins, with and without wool (see by-products). Total butterfat is comprised of partly actual and partly estimated figures, and indicates total production at the milk-pail, accounting for all losses, &c., from this stage forward. In the

Table 1.—Production on Unit Basis: Main Products.

Season.	Mutton.	Lamb.	Wool.	Total Sheep Industry.	Butter-fat.	Pigs.	Beef.	Calves	Total Units.
1901–2 ..	248	167	813	1,228	303	4	40	..	1,575
1902–3 ..	373	231	784	1,388	331	6	50	..	1,775
1903–4 ..	345	234	751	1,330	381	8	49	..	1,768
1904–5 ..	267	210	760	1,237	398	17	55	1	1,708
1905–6 ..	234	260	798	1,292	404	18	59	1	1,774
1906–7 ..	318	300	860	1,478	424	25	87	1	2,015
1907–8 ..	283	292	882	1,457	432	27	101	1	2,018
1908–9 ..	328	339	924	1,591	462	35	137	1	2,226
1909–10 ..	314	373	961	1,648	541	28	150	1	2,368
1910–11 ..	382	410	945	1,737	552	41	143	1	2,474
1911–12 ..	364	325	955	1,644	574	58	119	1	2,396
1912–13 ..	376	356	949	1,681	639	48	130	1	2,499
1913–14 ..	447	439	996	1,882	686	48	150	1	2,767
1914–15 ..	445	453	1,017	1,915	699	60	174	2	2,850
1915–16 ..	447	415	1,002	1,864	753	55	185	2	2,859
1916–17 ..	420	348	988	1,756	797	62	195	1	2,811
1917–18 ..	423	274	979	1,676	755	55	172	1	2,659
1918–19 ..	500	301	1,115	1,916	778	51	179	1	2,925
1919–20 ..	618	334	1,015	1,967	849	59	209	2	3,086
1920–21 ..	532	362	988	1,882	969	53	185	2	3,091
1921–22 ..	490	515	1,091	2,096	1,243	72	134	2	3,547
1922–23 ..	358	460	952	1,770	1,410	70	180	2	3,432
1923–24 ..	336	527	961	1,824	1,428	80	212	3	3,547
1924–25 ..	391	497	949	1,837	1,506	99	250	4	3,696
1925–26 ..	357	521	1,016	1,894	1,462	101	234	4	3,695
1926–27 ..	381	554	1,068	2,003	1,617	111	207	5	3,943

TABLE 2.—EXPORTS ON UNIT BASIS OF ANIMAL BY-PRODUCTS AND LIVE ANIMALS.

Season.	Skins (Sheep and Lamb).	Sausage-casings.	Kidneys.	Tallow.	Calf-skins.	Hides.	Hair, Horns, Lard.	Horses, Sheep, Cattle, Pigs (Live Animals).	Total.
1901–2 ..	145	27	1	42	0	5	5	17	242
1902–3 ..	166	29	2	40	0	5	1	6	249
1903–4 ..	141	25	1	32	0	5	1	3	208
1904–5 ..	111	22	1	32	0	10	1	4	181
1905–6 ..	125	27	2	38	1	13	1	5	212
1906–7 ..	160	31	2	41	2	18	1	5	260
1907–8 ..	145	28	1	37	1	18	3	3	236
1908–9 ..	167	32	1	28	2	19	5	7	261
1909–10 ..	177	45	2	52	1	18	11	17	323
1910–11 ..	174	44	1	41	2	13	9	19	303
1911–12 ..	181	63	1	47	2	15	8	8	325
1912–13 ..	187	62	1	45	2	17	6	5	325
1913–14 ..	196	81	2	49	2	22	7	11	370
1914–15 ..	218	89	2	47	3	27	8	19	413
1915–16 ..	201	45	2	45	3	30	5	9	340
1916–17 ..	163	36	2	25	1	18	7	2	254
1917–18 ..	219	40	1	33	1	21	4	2	321
1918–19 ..	213	46	3	94	1	32	7	1	397
1919–20 ..	231	50	2	54	3	29	3	2	374
1920–21 ..	209	45	18	55	6	33	1	2	369
1921–22 ..	242	45	2	45	6	22	2	2	366
1922–23 ..	193	43	1	50	8	34	3	6	338
1923–24 ..	208	50	1	48	9	47	5	2	370
1924–25 ..	209	56	1	50	9	50	4	2	381
1925–26 ..	216	63	1	42	9	45	7	2	385
1926–27 ..	230	62	1	48	10	40	5	2	398

absence of records of such items as milk and cream consumption *per capita*, whole-milk fed to calves, losses, &c., estimates are necessary in order to fill the blanks. This work was gone into very thoroughly, and may be accepted as reliable.

The products included in Table 1 may be termed primary grassland products. What are termed the by-products of these are given in Table 2. All figures in this table are exports for years ended 31st December. Little, if any, of the following season's production is likely to be included in these totals, because of the lag between production and export. Live animals exported may not be truly a by-product, but this item is of such minor importance that it was thought best to include it here. The total of these is given on the extreme right.

For convenience, Table 3 sets out total live-stock products divided into its main sections. Table 4 furnishes the reader with the numbers of dairy cows, total cattle, sheep and lambs, breeding-ewes, area occupied, and area of total grassland. All but the last are official figures of the Census and Statistics Office, with the exception of those years marked. For these years enumerations were not made, and the blanks for dairy cows and total cattle were completed on the geometric mean, and those for area occupied on the arithmetic mean. Total grassland is comprised of sown, native, and tussock grasses. A considerable amount of estimation was demanded to procure this figure, as beyond 1914–15 tussock- and native-grass areas were included with total unproductive area. The estimations were "smoothed," giving a "straight-line trend" throughout the entire period, instead of showing part actual and part estimated figures. It is considered that this estimation closely follows the actual position. Table 5 should be self-explanatory.

Sections (*a*) and (*d*) are based on all dairy cows in milk and dry. "Smoothed products per acre of total grassland" needs some explanation. Total live-stock products as given in Table 3 were smoothed on the straight-line secular trend, and these divided by the estimated figures for total grassland (which also are on a straight-line secular trend). "Percentage of area occupied which is unproductive" has been arrived at by expressing the difference between the straight-line figures for total grassland and total area occupied as a percentage of total area occupied. "Production per sheep as at 30th April" is obtained by dividing total sheep-industry figures (*i.e.*, lamb, mutton, and wool) by the number of sheep and lambs as at 30th April. This was considered the best base available for the purpose. Sections (*d*) and (*f*) are presented in graphical form in Diagrams 3 and 4 respectively.

It will be seen from the foregoing that we have available total live-stock production, numbers of stock, and area of grassland. From these it is possible to consider how unit production has fluctuated. Lamb, mutton, wool, butterfat, beef, and calf figures are selected as being directly associable to area of grassland. The pig industry has been excluded not because it is not a primary grassland product, but more because this industry has not been so fully exploited in early years as in the case of the others. By dividing the total of production for these sections by total area in grass we have figures for production per acre. The area devoted to crops for stock-feeding is difficult to handle in this question, and has been excluded.

TABLE 3.—TOTALS OF PRODUCTION FROM PASTURES ON UNIT BASIS.

Season.	Sheep-products.	Dairy-products.	Pigs, Cattle, Calves.	Live-stock By-products and Live Animals.	Total Live-stock Products.
1901–2 ..	1,228	303	44	242	1,817
1902–3 ..	1,388	331	56	249	2,024
1903–4 ..	1,330	381	57	208	1,976
1904–5 ..	1,237	398	73	181	1,889
1905–6 ..	1,292	404	78	212	1,986
1906–7 ..	1,478	424	113	260	2,275
1907–8 ..	1,457	432	129	236	2,254
1908–9 ..	1,591	462	173	261	2,487
1909–10 ..	1,648	541	179	323	2,691
1910–11 ..	1,737	552	185	303	2,777
1911–12 ..	1,644	574	178	325	2,721
1912–13 ..	1,681	639	179	325	2,824
1913–14 ..	1,882	686	199	370	3,137
1914–15 ..	1,915	699	236	413	3,263
1915–16 ..	1,864	753	242	340	3,199
1916–17 ..	1,756	797	258	254	3,065
1917–18 ..	1,676	755	228	321	2,980
1918–19 ..	1,916	778	231	397	3,322
1919–20 ..	1,967	849	270	374	3,460
1920–21 ..	1,882	969	240	369	3,460
1921–22 ..	2,096	1,243	208	366	3,913
1922–23 ..	1,770	1,410	252	338	3,770
1923–24 ..	1,824	1,428	295	370	3,917
1924–25 ..	1,837	1,506	353	381	4,077
1925–26 ..	1,894	1,462	339	385	4,080
1926–27 ..	2,003	1,617	323	398	4,341

NOTE.—Figures for 1927–28 now available: Sheep-products, 2,097; dairy-products, 1,651; pigs, cattle, calves, 361; live-stock by-products and live animals, 418: total live-stock products, 4,527 units.

TABLE 4.—TOTALS OF STOCK, AREAS OCCUPIED, AND AREA IN GRASS.

Season.	Total Cows in Milk or Dry at 31st January.	Total Cattle at 31st January.	Total Sheep and Lambs at 30th April.	Breeding-ewes at 30th April (Flock and Stud).	Total Area occupied.	Total Area in Grass ("Smoothed" Estimate): Sown, Native and Tussock.
					Acres.	Acres.
1901–2 ..	381,492	1,361,784	20,342,727	9,610,149	35,507,889	28,412,100
1902–3 ..	428,773	1,460,663	18,954,553	9,071,751	35,887,447	28,545,500
1903–4 ..	468,125	1,593,547	18,280,806	9,222,448	36,476,481	28,678,900
1904–5 ..	498,241	1,736,850	19,130,875	10,079,184	36,511,154	28,812,300
1905–6 ..	517,720	1,810,936	20,108,471	10,479,187	37,167,460	28,945,700
1906–7 ..	543,927	1,851,750	20,983,772	10,736,846	37,408,473	29,079,100
1907–8 ..	541,363	1,816,299	22,449,053	11,244,041	37,564,288	29,212,500
1908–9 ..	536,629	1,773,326	23,480,707	12,370,346	38,204,349	29,345,900
1909–10 ..	583,163*	1,892,729*	24,269,620	12,515,380	39,221,237*	29,479,300
1910–11 ..	633,733	2,020,171	23,996,126	12,324,463	40,238,126	29,612,700
1911–12 ..	655,503*	2,094,033*	23,750,153	12,277,029	40,467,709*	29,746,100
1912–13 ..	678,021*	2,170,595*	24,191,810	12,521,036	40,697,292*	29,879,500
1913–14 ..	701,312*	2,249,956*	24,798,763	12,920,176	40,926,875*	30,012,900
1914–15 ..	725,403*	2,332,219*	24,901,421	12,615,341	41,156,458*	30,146,300
1915–16 ..	750,323	2,417,491	24,788,150	12,892,767	41,386,040	30,279,700
1916–17 ..	777,439	2,575,230	25,270,386	13,260,169	42,744,719	30,413,100
1917–18 ..	793,212	2,869,465	26,538,302	13,022,034	43,212,079	30,546,500
1918–19 ..	826,135	3,035,478	25,828,554	12,341,900	43,342,706	30,679,900
1919–20 ..	903,454	3,101,945	23,919,970	11,569,675	43,473,079	30,813,300
1920–21 ..	1,004,666	3,139,223	23,285,031	12,147,788	43,546,757	30,946,700
1921–22 ..	1,137,055	3,323,223	22,222,259	12,496,054	43,528,337	31,080,100
1922–23 ..	1,248,643	3,480,694	23,081,439	13,063,003	43,653,163	31,213,500
1923–24 ..	1,312,588	3,563,497	23,775,776	13,076,094	43,572,564	31,346,900
1924–25 ..	1,323,432	3,503,744	24,547,955	13,715,223	43,632,372	31,480,300
1925–26 ..	1,303,856	3,452,486	24,904,993	13,948,252	43,606,829	31,613,700
1926–27 ..	1,303,225	3,257,729	25,649,016	14,831,730	43,587,698	31,747,100

* Interpolated.

At the same time, production per acre has been considerably affected by feed crops. It has been assumed that each cattle beast is equivalent to six sheep in grass-consumption. All cattle have been converted to sheep units of stock on this basis, all dairy and beef animals being included, whether mature, two-year-olds, yearlings, or calves. The conversion figure adopted is considered a reasonable one in the light of information available. However, were the value taken as five or seven, it would not materially affect the trends established from the other. By dividing total production by the total sheep units of stock we obtain a figure of production per animal, assuming all stock to be sheep. Sheep units of stock carried per acre of all grassland is derived by dividing total sheep units of stock by total acres of all grassland. We now have figures for production per acre and per head of stock, and stock carried per acre. These three factors are the principal ones to be studied in considering production. In Diagram 1, curves have been given on a common scale to facilitate comparison, and depict (1) total production of lamb, mutton, wool, butterfat, beef, and calf; (2) production of lamb, mutton, wool, butterfat, beef, and calf per acre of all grassland; (3) total sheep units of stock carried; (4) sheep units of stock carried per acre of all grassland; (5) production of lamb, mutton, wool, butterfat, beef, and calf per sheep unit of stock carried; and (6) total grassland (*i.e.*, sown, native, and tussock grasses). The whole lines give the actual points for the various years, while the broken lines indicate the straight-line secular trends. No actual figures have been quoted for all grassland, since this could only be done from 1915–16 onwards. Secular trends have been obtained from the range 1901–2 to 1925–26 by taking

moments about the mid-point — viz., 1913–14 — allotting the arithmetic mean to this year, and adding or substracting from this value year by year an amount derived by dividing the sum of the moments by the sum of the squares of the intervals from the mid-point. There are several methods in common use to establish the secular trend, the one of moving averages being probably the most reliable for all purposes. Where the data exhibits straight-line tendency it is simpler to employ the straight-line "smooth." All the curves shown in Diagram 1 are of a decided straight-line trend, and it is therefore reasonable to smooth them by the straight-line method. The 1901–2 point of the secular trends was used as the base in converting the other points of the curves to a percentage or index-number basis. The scales, therefore, show percentage increase over the first year of the secular trends. The values for the actual points of these curves are given in Table 6. The similarity in the trend of the actual points of the first and second and the third and fourth curves is dues to the data in the first and third curves being divided by total grassland figures, which are in straight-line trend. Had actual values been available for the latter throughout its entire range this could have been avoided. This point, however, does not detract from the value of the second and fourth curves. In Diagram 2 the secular trends of the six curves of Diagram 1 are given commencing from a common point, in order to show the relative increase of each on a percentage basis during the period under review. The secular trend is the most reliable base to employ in showing percentage variation during a period. Diagrams 3 and 4 show production of butterfat per cow and return per

TABLE 5.

Season.	Value or Standard Values of			Butterfat Production per Cow.	Percentage of Area occupied which is unproductive.	Value of Sheep-products per Sheep (as at 30th April).
	Dairy-products per Cow.	Total Products per Acre occupied.	"Smoothed" Total Products per Acre of Sown, Native, and Tussock Grasses.			
	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
	£	£	£	lb.	Per Cent.	£
1901–2 ..	7·942	0·512	0·640	127·20	19·98	0·604
1902–3 ..	7·720	0·564	0·667	123·48	20·46	0·732
1903–4 ..	8·139	0·542	0·695	130·34	21·38	0·728
1904–5 ..	7·988	0·517	0·723	127·83	21·09	0·647
1905–6 ..	7·803	0·534	0·750	124·74	22·12	0·643
1906–7 ..	7·795	0·608	0·778	124·79	22·27	0·704
1907–8 ..	7·980	0·600	0·806	127·66	22·23	0·649
1908–9 ..	8·609	0·651	0·833	139·25	23·19	0·678
1909–10 ..	9·277	0·686	0·861	148·45	24·84	0·679
1910–11 ..	8·710	0·690	0·888	139·46	26·41	0·724
1911–12 ..	8·757	0·672	0·916	140·10	26·49	0·692
1912–13 ..	9·424	0·694	0·944	150·78	26·58	0·695
1913–14 ..	9·782	0·766	0·971	156·52	26·67	0·759
1914–15 ..	9·636	0·793	0·999	154·07	26·75	0·769
1915–16 ..	10·036	0·773	1·027	160·52	26·84	0·752
1916–17 ..	10·252	0·717	1·054	163·96	28·85	0·695
1917–18 ..	9·518	0·690	1·082	152·23	29·31	0·632
1918–19 ..	9·417	0·766	1·110	150·64	29·22	0·742
1919–20 ..	9·502	0·796	1·137	152·04	29·12	0·822
1920–21 ..	9·645	0·795	1·165	154·25	28·93	0·808
1921–22 ..	10·932	0·899	1·192	174·97	28·60	0·943
1922–23 ..	11·292	0·864	1·220	180·62	28·50	0·767
1923–24 ..	10·879	0·899	1·248	174·10	28·06	0·767
1924–25 ..	11·380	0·934	1·275	182·09	27·85	0·748
1925–26 ..	11·213	0·936	1·303	179·40	27·50	0·760
1926–27 ..	12·408	0·996	1·331	198·50	27·16	0·781

TABLE 6.

Season.	Production of Lamb, Mutton, Wool, Butterfat, Beef, and Calf (based on Standard Values).			Sheep Units of Stock carried on all Grassland (each Cattle Beast equals Six Sheep).	
	Total Production (in £10,000).	Production per Acre of all Grassland (in £).	Production per Sheep Unit of Stock carried (in £).	Total Sheep Units of Stock carried (in 10,000).	Sheep Units of Stock per Acre of all Grassland.
1901–2 ..	1571	0·553	0·551	2851	1·004
1902–3 ..	1769	0·620	0·638	2772	0·971
1903–4 ..	1760	0·614	0·632	2784	0·971
1904–5 ..	1691	0·587	0·572	2955	1·026
1905–6 ..	1756	0·607	0·567	3097	1·070
1906–7 ..	1990	0·684	0·620	3209	1·104
1907–8 ..	1991	0·682	0·597	3335	1·142
1908–9 ..	2191	0·747	0·642	3412	1·163
1909–10 ..	2340	0·794	0·657	3563	1·209
1910–11 ..	2433	0·822	0·674	3612	1·220
1911–12 ..	2338	0·786	0·644	3631	1·221
1912–13 ..	2451	0·820	0·659	3722	1·246
1913–14 ..	2719	0·906	0·710	3830	1·276
1914–15 ..	2790	0·925	0·717	3889	1·290
1915–16 ..	2804	0·926	0·714	3929	1·298
1916–17 ..	2749	0·904	0·675	4072	1·339
1917–18 ..	2604	0·852	0·595	4376	1·432
1918–19 ..	2874	0·937	0·653	4404	1·436
1919–20 ..	3027	0·982	0·712	4253	1·380
1920–21 ..	3038	0·982	0·721	4212	1·361
1921–22 ..	3475	1·118	0·824	4216	1·357
1922–23 ..	3362	1·077	0·765	4397	1·409
1923–24 ..	3467	1·106	0·768	4516	1·441
1924–25 ..	3597	1·143	0·789	4557	1·448
1925–26 ..	3594	1·137	0·788	4562	1·443
1926–27 ..	3832	1·207	0·848	4520	1·424

sheep respectively, and are based on figures appearing in columns (*d*) and (*f*) of Table 5. Diagram 5 is based on the data shown in curves two, four, and five of Diagram 1, and gives the percentage variation of the actual points of these curves about the corresponding points on their secular trends. Imagine the inclined secular-trend lines of Diagram 1 brought to the horizontal and coincidence with one another, and this gives the significance of the zero line of Diagram 5. The actual points about the secular trends are plotted on a percentage basis in order to bring these to a common scale. Table 7 gives the readings of the plotted points. It is interesting to note that production per head of stock varies inversely with stock carried per acre of grassland between 1901–2 and 1905–6, and between 1915–16 and 1926–27. For the portion between 1905–6 and 1915–16 the correlation is direct, except for years 1907–8 and 1910–11. For later years we find that reduction in stock carried per acre has been coincident with increase in both production per head of stock and per acre of grassland.

SUMMARY.

The total volume of production derived mainly from the grasslands of New Zealand has shown an appreciable increase over the period under review. It will be seen from Table 6 that, when measured in standard units, the rise has been steady (with minor fluctuations), rising from 1571 to 3832 units. The top line of Diagram 2 shows the trend of increase over the whole period, amounting to 136·7 per cent. The total increase has been contributed to by all branches of grassland products, but mainly by butterfat, lamb, wool, and beef.

The trend of increased production and efficiency is best studied from Diagram 2, where all features are shown starting from a common point.

It will be seen that—

(1) The total grassland farmed has increased by 11·7 per cent.

(2) When all cattle are reduced to sheep equivalents the total number of sheep units carried has increased by 69·7 per cent. Thus it is shown that the stock carried per grass acre has increased.

(3) This increased carrying-capacity of stock units per acre of all grassland amounts to 51·8 per cent.

(4) The total production of lamb, mutton, wool, butterfat, beef, and calf products has increased by 136·7 per cent., showing that –

(5) The production per acre of grasslands has increased for these products by 109·9 per cent. As total production has increased more rapidly than have the units of stock carried or the area of grassland, we find that—

(6) Production of lamb, mutton, wool, butterfat, beef, and calf products has increased by 37·2 per cent. per sheep unit of stock carried.

The increases given for (3), (5), and (6) when calculated directly from the base quantities—*i.e.*, (1), (2), and (4)—are respectively 51·9 per cent., 111·9 per cent., and 39·4 per cent., the variations being due to the operations of "smoothing."

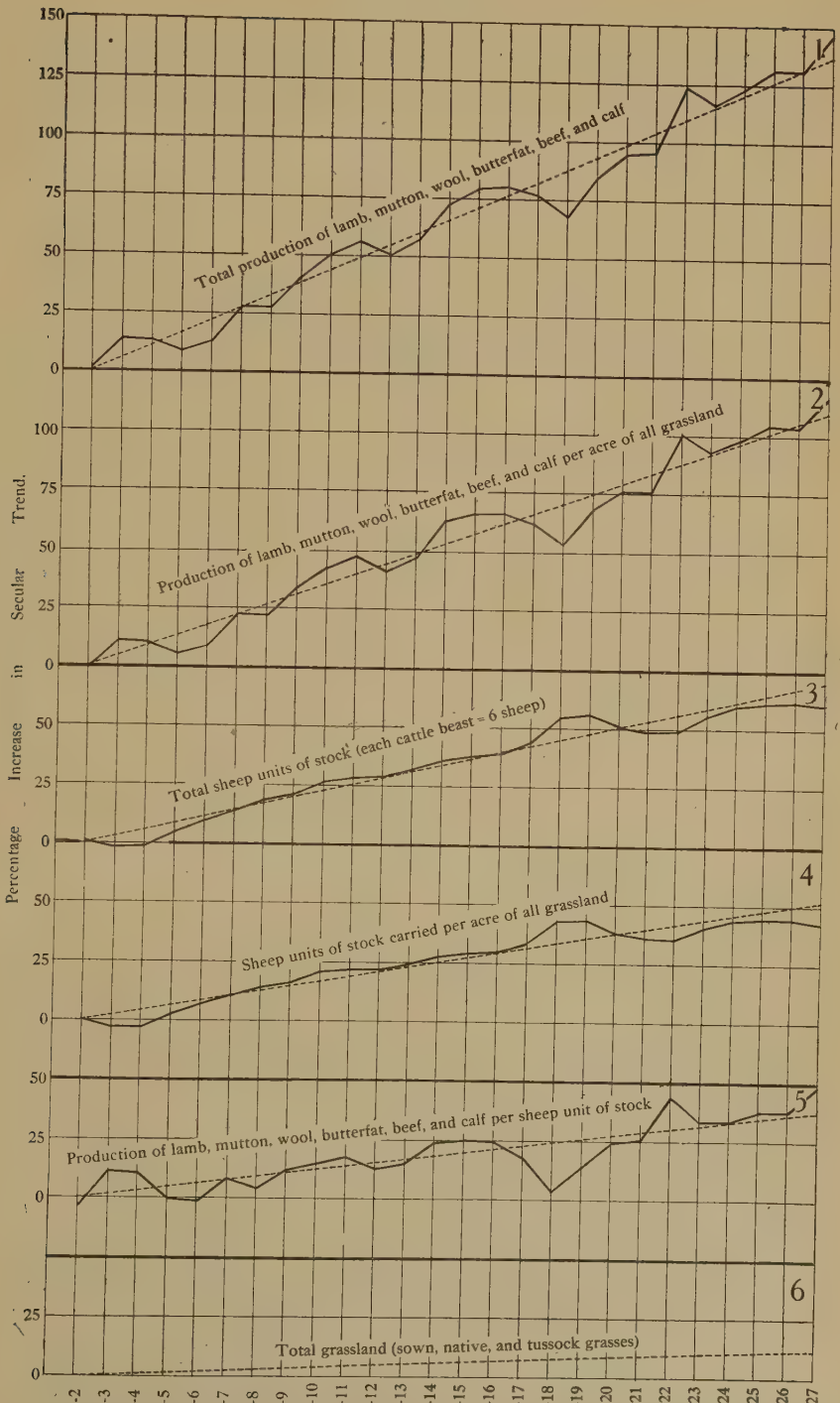
It must be appreciated that all animal products are not produced from grass alone, sown crops of the rape, turnip, and green-feed type being supplementary factors.

It should also be noted that capital represented by the increase in stock of all classes is considerable. This has not been included as an item of production, although it might justly be interpreted as such. Capital represented by increased area of improved land is in the same category. The data used represent the annual position from the farmers' viewpoint as nearly as it can be ascertained.

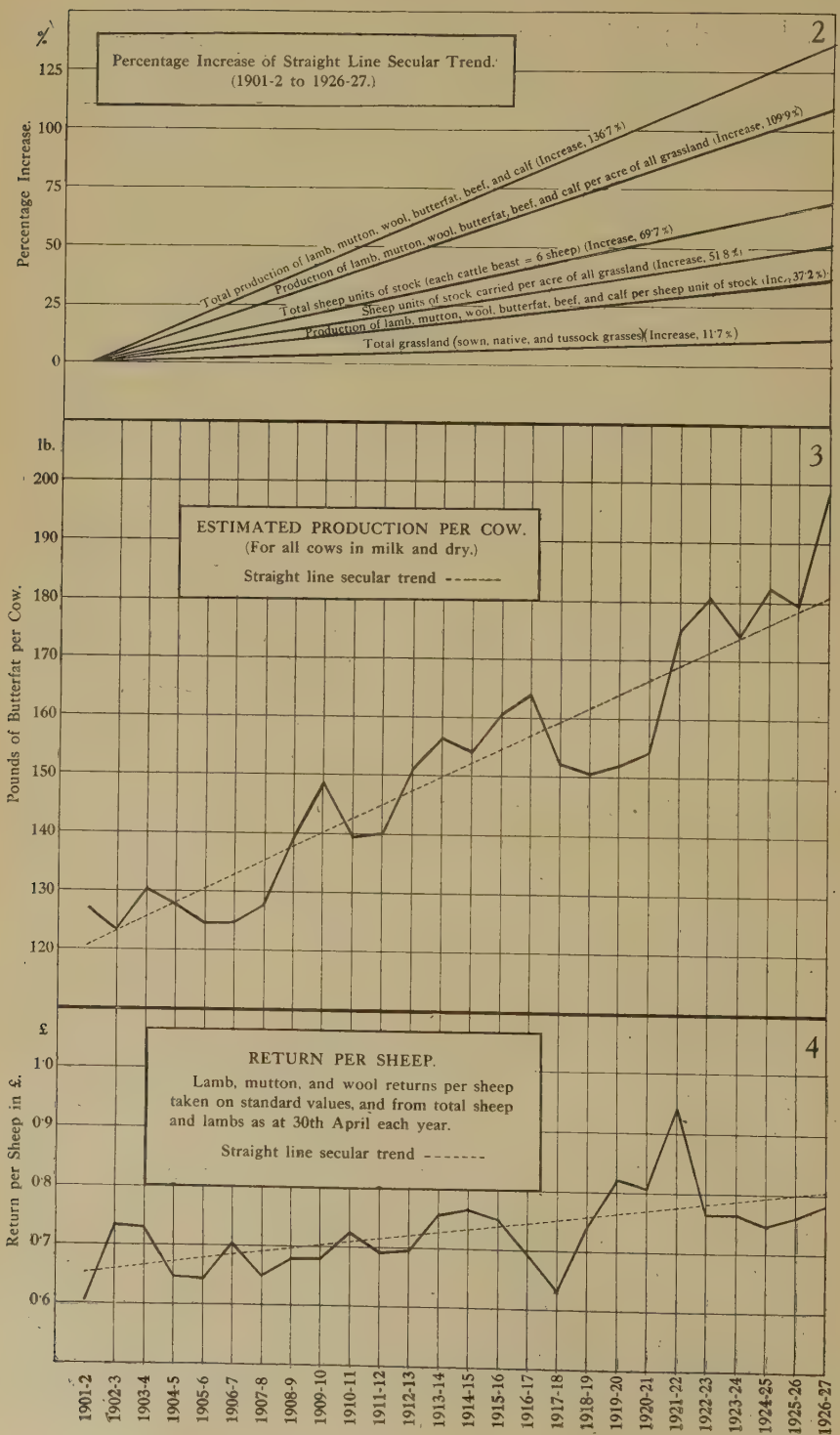
TABLE 7.—PERCENTAGE VARIATION ABOUT SECULAR TREND.

Season.	Production of Lamb, Mutton, Wool, Butterfat, Beef, and Calf per Acre of all Grassland.	Sheep Units of Stock carried per Acre of all Grassland.	Production of Lamb, Mutton, Wool, Butterfat, Beef, and Calf per Sheep Unit of Stock carried.
	Per Cent.	Per Cent.	Per Cent.
1901–2	−0·896	+0·299	−3·839
1902–3	+6·346	−4·990	+9·621
1903–4	+1·153	−6·903	+7·118
1904–5	−7·120	−3·480	−6·507
1905–6	−7·469	−1·291	−6·589
1906–7	+0·440	−0·090	+0·649
1907–8	−3·262	+1·420	−4·326
1908–9	+2·328	+1·483	+1·421
1909–10	+5·305	+3·598	+2·496
1910–11	+5·519	+2·693	+3·692
1911–12	−2·117	+0·992	−2·127
1912–13	−0·966	+1·300	−1·199
1913–14	+6·338	+2·080	+5·185
1914–15	+5·473	+1·494	+4·824
1915–16	+2·774	+0·464	+3·179
1916–17	−2·375	+1·980	−3·708
1917–18	−10·410	+7·426	−16·078
1918–19	−3·897	+6·056	−9·052
1919–20	−1·800	+0·363	−1·928
1920–21	−4·101	−2·507	−1·904
1921–22	+6·577	−4·166	+10·901
1922–23	+0·372	−1·948	+1·728
1923–24	+0·728	−1·165	+1·052
1924–25	+1·871	−2·096	+2·600
1925–26	−0·871	−3·735	+1·415
1926–27	+3·074	−6·315	+7·888

DIAGRAM 1.


Percentage Increase in Secular Trend.
1
Total production of lamb, mutton, wool, butterfat, beef, and calf
2
Production of lamb, mutton, wool, butterfat, beef, and calf per acre of all grassland
3
Total sheep units of stock (each cattle beast = 6 sheep)
4
Sheep units of stock carried per acre of all grassland
5
Production of lamb, mutton, wool, butterfat, beef, and calf per sheep unit of stock
6
Total grassland (sown, native, and tussock grasses)
1901-2
1902-3
1903-4
1904-5
1905-6
1906-7
1907-8
1908-9
1909-10
1910-11
1911-12
1912-13
1913-14
1914-15
1915-16
1916-17
1917-18
1918-19
1919-20
1920-21
1921-22
1922-23
1923-24
1924-25
1925-26
1926-27

DIAGRAMS 2, 3, AND 4.



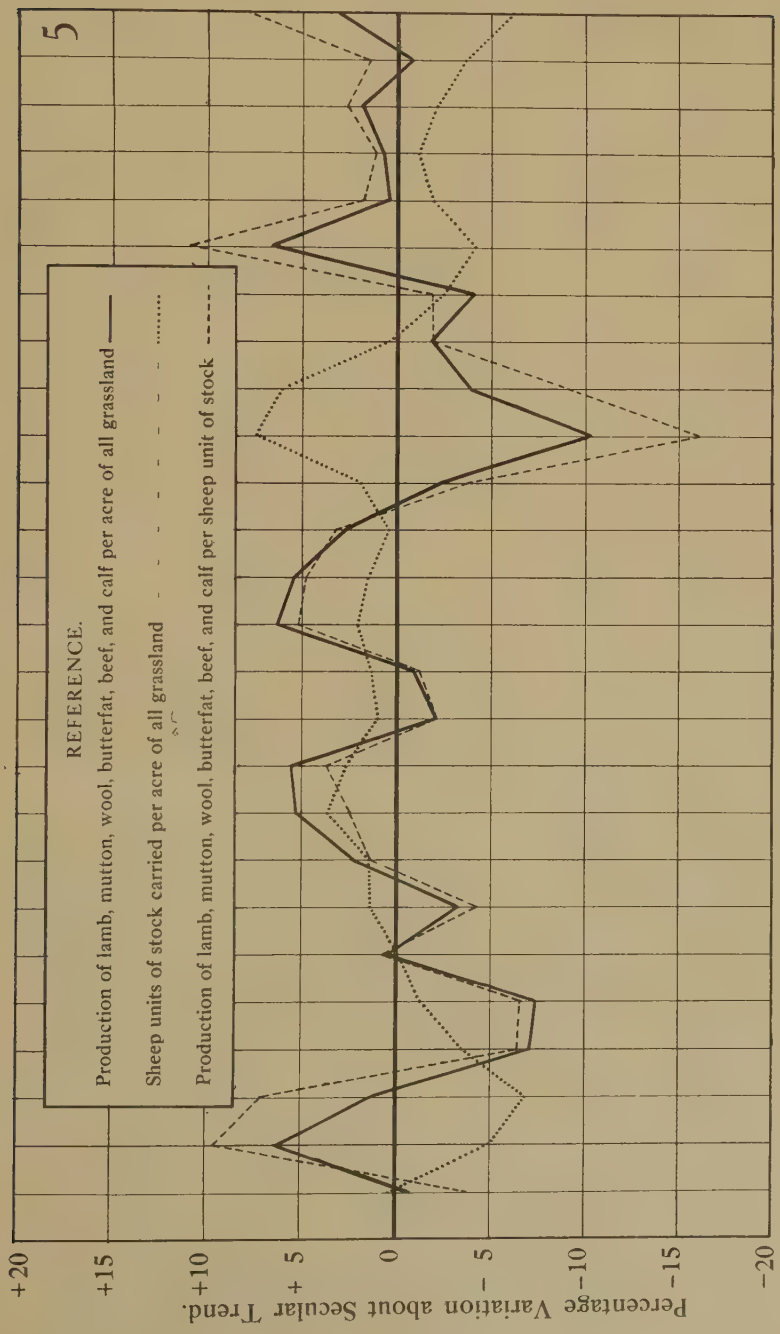

5
REFERENCE.
Production of lamb, mutton, wool, butterfat, beef, and calf per acre of all grassland
Sheep units of stock carried per acre of all grassland
Production of lamb, mutton, wool, butterfat, beef, and calf per sheep unit of stock
Percentage Variation about Secular Trend.
+20
+15
+10
+ 5
0
− 5
−10
−15
−20
1901-2
1902-3
1903-4
1904-5
1905-6
1906-7
1907-8
1908-9
1909-10
1910-11
1911-12
1912-13
1913-14
1914-15
1915-16
1916-17
1917-18
1918-19
1919-20
1920-21
1921-22
1922-23
1923-24
1924-25
1925-26
1926-27

DIAGRAM 5.

WEATHER RECORDS: MAY, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

MAY was a very dry month over the whole of the South Island and the greater portion of the North Island. The only areas where the total rainfall exceeded the average were the Auckland Peninsula and most of the Gisborne and Hawke's Bay districts. Many places in the South Island experienced the lowest May rainfall since records have been kept.

Although temperatures, on the whole, were lower than usual, there was an absence of strong wind, except for short periods, and this, combined with the frequency of sunny days, was conducive to an excellent growth of pasture for this time of the year.

The main meteorological feature of the month has again been a relative absence of westerly winds, owing to pressure systems of the cyclonic type having been most prominent. The only depression of the westerly type of any importance experienced was one which prevailed between the 8th and 10th, and the greater part of the rainfall registered in Westland was associated with this disturbance.

There were a number of small cyclones, which in most cases passed across northern New Zealand, and brought rain mainly to the northern and east coast provinces of the North Island.

The most notable storm was a cyclone which appeared first on the 11th as a small centre to the north-west of Cape Maria van Diemen. Gradually increasing in extent and intensity as it moved southwards, it affected all parts of the Dominion, rain being general between the 14th and 16th. From Marlborough northwards stormy conditions prevailed with strong south-east to south winds, which in some places reached gale force. Very heavy rains fell in the east coast districts of the North Island. Rivers overflowed, and much of the lowlying country in the Wairarapa, Hawke's Bay, and Gisborne districts became flooded. Many bridges were carried away and roads were damaged, serious interference with traffic resulting. Although there was some loss of stock, the ample warning of floods enabled farmers to take all possible precautions. The loss, therefore, was far less than it might otherwise have been. On the 15th this cyclone was centred north of the Bay of Plenty, and by the 16th it was moving off East Cape. By that time its worst effects were over.

Anticyclonic conditions and fine weather were general from the 17th to the 19th, but thereafter until the 29th the weather was somewhat unsettled and changeable with scattered rain, chiefly in eastern districts. During this last period several cyclones moved over the northern Tasman Sea and across northern New Zealand, but their effects were not widespread. On the 28th some severe hail-storms were experienced at places in the far North in association with a cyclone the centre of which passed north of Cape Maria van Diemen during the night of the 27th. Fine weather set in on the 29th and continued until the close of the month, an extensive anticyclone gradually intensifying over the Dominion.

Frosts were frequent during the month, and on the 31st a severe one occurred in many parts.

—*Edward Kidson, Director of Meteorological Services.*

RAINFALL FOR MAY, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	6·57	15	1·30	5·06
2	Russell	11·64	20	1·24	5·92
3	Whangarei	13·68	24	2·94	7·84
4	Auckland	4·10	21	0·87	4·50
5	Hamilton	2·42	11	0·70	4·54
6	Kawhia	3·22	11	0·73	5·57

RAINFALL FOR MAY—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island—continued.				
		Inches.		Inches.	Inches.
7	New Plymouth	4·35	11	1·18	6·23
8	Riversdale, Inglewood ..	4·29	11	1·30	9·82
9	Whangamomona	6·49	9	1·29	7·05
10	Eltham	3·30	13	0·93	5·27
11	Tairua	6·91	14	1·41	7·64
12	Tauranga	2·84	11	0·98	5·16
13	Maraehako Station, Opotiki	5·46	10	1·86	5·70
14	Gisborne	8·33	19	3·05	5·67
15	Taupo	2·93	10	0·67	4·09
16	Napier	5·57	14	2·57	3·74
17	Maraekakaho Station, Hastings	7·01	15	4·04	3·52
18	Taihape	1·95	11	0·43	3·84
19	Masterton	3·33	14	1·01	4·03
20	Patea	2·80	11	0·68	4·34
21	Wanganui	3·03	9	0·93	3·42
22	Foxton	3·02	6	1·04	2·78
23	Wellington (Karori Reservoir)	4·29	11	1·34	4·40
	South Island.				
24	Westport	2·75	9	1·05	6·58
25	Greymouth	3·98	8	1·12	8·01
26	Hokitika	3·98	9	1·56	9·71
27	Ross	4·45	8	1·26	9·73
28	Arthur's Pass	5·37	6	2·50	11·02
29	Okuru, Westland	4·06	6	1·95	11·60
30	Collingwood	2·82	10	0·71	10·18
31	Nelson	0·54	7	0·20	3·08
32	Spring Creek, Blenheim ..	0·49	5	0·12	3·19
33	Tophouse	2·17	7	0·73	5·94
34	Hanmer Springs	2·17	6	1·26	4·51
35	Highfield, Waiau	1·88	5	0·86	3·41
36	Gore Bay	1·63	5	0·70	3·83
37	Christchurch	0·51	5	0·27	2·65
38	Timaru	0·46	4	0·28	1·41
39	Lambrook Station, Fairlie ..	0·87	2	0·44	1·53
40	Benmore Station, Clearburn	0·46	5	0·28	1·97
41	Oamaru	..	..	..	1·61
42	Queenstown	0·64	3	0·36	2·63
43	Clyde	0·26	2	0·24	0·97
44	Dunedin	0·50	6	0·37	3·23
45	Wendon	1·08	7	0·37	2·23
46	Gore	1·48	11	0·58	2·71
47	Invercargill	2·46	12	0·85	4·46
48	Puysegur Point	5·93	17	1·30	6·81
49	Half-moon Bay	2·81	11	0·53	4·50

FOOT-AND-MOUTH DISEASE IN BRITAIN.

THE High Commissioner reported by cable from London on 4th June that there had been no outbreak of foot-and-mouth disease in Great Britain since 24th March last. Although it must not be inferred from this that the disease has been entirely eliminated, the information discloses a much more satisfactory position in Britain than has obtained for a considerable time past.

REVIEW.

The New Flora and Silva: A quarterly horticultural journal, edited by E. H. M. Cox, F.L.S. Dulau and Co., Ltd., London. Annual subscription, £1.

THE flora of the earth—that collection of species forming a living mosaic covering much of its surface, and known as the vegetation—though changing with unthinkable slowness, yet has remained unchanged since the beginning of historical time. On the contrary, the flora of our gardens has never remained stationary, but, even during the last quarter of a century, has altered greatly, partly through the dictates of fashion, partly through the self-sacrificing exertions of botanical explorers, and partly through the skill of the plant-breeders. Thus the title of the journal under review—*The New Flora and Silva*—though to some it may seem rather odd, is an excellent statement of facts. Those of us no longer young have witnessed change after change in the horticultural flora, so that at the present time it resembles but little that of the mid-Victorian period. It is true that the word "Silva" is really included in the term "flora," but the use of the two emphasizes the fact that the journal deals not only with the herbaceous plants and shrubs of gardens but with the trees of parks, plantations, and woodlands.

Considering that Great Britain leads the world as a land of flower-gardens, it seems rather strange that, up to the advent of the new journal, there were only the two weekly horticultural papers—both playing an important and worthy part—and the *Journal of the Royal Horticultural Society*. But in these a considerable portion of the contents consists of general news, whereas such finds no place in *The New Flora and Silva*, its pages being devoted entirely to articles treating of the subjects its title indicates, but omitting matter connected with bedding-out and the like. "There is no intention"—quoting from the editorial in the first number—"of casting aspersions at tried favourites or of belittling the ordinary gardener who likes to see his soil produce excellent crops and his beds blaze with colours, but his tastes are well covered by other horticultural journals. What has been lacking is a journal which caters solely for the keen gardener who is ambitious, for the gardener who is interested in particular groups of plants, for the gardener who wishes to enlarge his collections, and, above all, for the gardener who desires to learn about the best plants and the best methods of cultivation."

Judging from the first two numbers—all published so far—the foregoing objects stand out clearly in their twenty-five articles, all contributed by horticulturists of note—*e.g.* (to name a few), W. J. Bean (Kew), E. A. Bunyard, Gertrude Jekyll, R. L. Harrow (Edinburgh), Lady Moore, Camillo Schneider, and E. H. Wilson (Arnold Arboretum). To give some idea of the value of the contents (taken almost haphazard) for New Zealand gardens, there is an account of those primulas sufficiently easy of cultivation as to permit their use in the "wild garden"; new sweet-peas are critically dealt with; very timely is the article on "garden favourites of seventy years ago" (what a long list could be drawn up for this country of the banished plants, whose return to our gardens would be indeed welcome); varieties of *Delphinium* specially worthy of cultivation; much-wanted notes on the species of *Berberis*; and a delightful article (one of a series) on cherries, under the title "The Anatomy of Dessert."

That the journal will be ably conducted is evidenced by the fact that it is under the expert editorship of E. H. M. Cox—gardener, botanical explorer, and admirable horticultural writer. Its format leaves little to be desired, with the good paper, clear print, and excellent illustrations. In short, the reviewer can confidently recommend the new magazine to those New Zealand amateur gardeners who wish their gardens to be full of beauty and of interest throughout the year, and are not content to slavishly follow any prevailing fashion, but who may not know what is best to grow, be such novelties or old favourites—indeed, both to skilled and unskilled it pages should appeal.

L.C.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLINDNESS IN SHEEP.

P.T.B., Ongarue :—

Fifteen to twenty of my ewes are troubled [month of May] with complete blindness. A cataract has come over both eyes, being abnormal on the pupil. The worst affected sheep are unable to be driven, and wander into obstructions, thus injuring themselves. Would you advise me what means to adopt to allay the complaint.

The Live-stock Division :—

When sheep are on the flush autumn feed, or even later when they are on turnips, it is not rare for them to become affected with blindness. The affection appears to be caused by some disturbance of the digestive system due to an unbalanced diet. The complaint is usually of a temporary nature, and will generally disappear from a flock if the sheep are changed on to a short, sweet pasture. We would suggest that you give your sheep as much exercise and as much change as possible by moving them at least every third day. The affected ewes should be dosed with Epsom salts, 4 oz. dissolved in a large cupful of hot water being the dose required. A few drops of an eye-lotion, made by dissolving ½ dram of sulphate of zinc in a pint of boiled water, should be poured on to the affected eyes daily. Another eye-lotion is made by dissolving 1 oz. of boracic acid in a pint of water.

CONTROL OF TUTU.

"TUTU," Balclutha :—

Could you give me any information on destroying tutu ? It is of the small variety, grows annually from below ground, and is situated on fairly steep faces.

The Fields Division :—

From the description of the tutu in question we presume that it is either *Coriaria thymifolia* or *Coriaria angustissima*. The latter variety is recognized by its rather large blackish fruit. The eradication of this plant has been a bane to many farmers, and numerous methods have been adopted, but results have not been very satisfactory. Where and when practicable the most efficient method is to grub it out. A method which has been tried with some success is that of herding goats on the patches of tutu, penning them for some time on the infected areas, when they have been known to eat quite a large proportion of the plant.

LONG KEEPING OF ONIONS.

J.D., Okoia :—

I should be obliged if you would let me know the best way to grow onions which will keep late in the season. I had an excellent crop the last two years. They were well ripened when harvested, and hung in a cool airy shed, but from now on they get soft. I have been in the habit of sowing Giant Rocca and Ailsa Craig in the autumn and Brown Spanish in the spring.

The Horticulture Division :—

To keep onions in good condition until late in the season is not an easy matter even under the best circumstances, and some growers even go to the expense of placing them in cold storage. The climate of your locality is not such as one would expect to grow a type of onion with first-rate keeping-qualities. Of the varieties you mention the Brown Spanish only should be retained for late use, and of these only the medium-sized bulbs. With small quantities these may be

strung, and kept in a place that is not only cool and airy but also dry. A dressing of 1 oz. sulphate of potash per square yard before sowing would very possibly improve the condition of the onions for storage purposes, but if the crop has to be harvested in moist weather it is best to make no attempt to keep it for a long period.

WINTER GRAZING OF YOUNG PASTURE.

D. M. BLACK, Riverton :—

What number of lambs will 20 acres of oats and grass sown on 12th March winter, hay being fed as well? Would feeding off during July and August affect the growth of cocksfoot? There is a fine strike; 2 bushels of Algerians were sown with the usual permanent pasture mixture.

The Fields Division :—

As a permanent grass mixture has been sown with the oats, and as the establishment of grass is the ultimate aim, every care in grazing should be taken through the first year. For this reason it is not advisable to put out a mob of lambs or other stock and pasture them solely on this crop. The result of such a course is usually a field grazed in a patchy manner, with the young sweet herbage getting too drastic a grazing, and some being left to run rank. Rank growth in a young pasture during the winter soon makes the "bottom" colourless and fuzzy. Also, the closely grazed herbage would receive too much attention, and the slower establishing and hence more permanent elements like cocksfoot would receive a set-back. Your best plan would be to graze the pasture when about 5 in. to 6 in. high with a mob of, say, seven hundred to eight hundred lambs. It would be even better to divide the field in half with a temporary netting fence and graze off with two separate mobs of lambs, or graze alternately, never letting the growth get above 6 in. and never grazing it below 5 in. high. Whereas it is correct practice to graze at a short stage of 3 in. to 4 in. during the summer months, it is not advisable to graze so close during winter. Use a light harrow after the lambs to sweeten the pasture. Close the field again until another 5 in. to 6 in. growth is forward, then graze off again. The grazing-off should be done fairly quickly in, say, seven to ten days at the most, and if the number of lambs cannot cope with the growth in this time more sheep should be placed on the area. This system of grazing would allow you to get the full utilization of your oats without impairing the young grass unduly. Certainly continuous grazing throughout July and August would seriously affect the grass-growth. It might pay you well to top-dress this block with about ¾ cwt. to 1 cwt. of sulphate of ammonia per acre after the first grazing. This would force the growth of both oats and grass, and give you extra grazing during the early spring before pasture growth is well forward.

STOCK SLAUGHTERED, 1928–29.

FOLLOWING are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1929 :—

Stock.	Abattoirs.	Meat-export Slaughter-houses.	Bacon-factories.	Ordinary Slaughter-houses.	Totals 1928–29.	Totals 1927–28.
Cattle ..	155,302	165,643	..	82,385	403,330	462,639
Calves ..	50,457	342,582	..	1,948	394,987	163,380
Sheep ..	584,856	2,156,034	..	239,176	2,980,066	3,180,274
Lambs ..	95,982	6,031,011	..	22,489	6,149,482	5,932,420
Swine ..	129,641	270,084	45,084	25,684	470,493	455,397

—*Live-stock Division.*